

State of California
Energy Resources Conservation and Development Commission

**ADVANCED TRANSPORTATION TECHNOLOGY STAKEHOLDERS
(ATTS) FORUM**

Theme:

**"Transportation Technology Partners
for California and the World"**

Friday, November 21, 1997
9 a.m to 3 p.m.

Held at the:

California Energy Commission
1516 Ninth Street, Hearing Room B
Sacramento, California

Transcript of Forum Reported by: George Palmer

STAFF PRESENT

(Alphabetically listed)

McKINLEY ADDY, Energy Technology Development Division

AVTAR BINING, Ph.D., Program Manager, Transportation and Energy
Technologies Advancement Program

SUSAN BROWN, Deputy Director, Transportation Technology & Fuels Office

NANCY DELLER, Deputy Director, Energy Technology Development Division

JAMES FOLKMAN, Energy Technology Development Division

DAN FONG, Senior Policy Analyst, Transportation Technology and Fuels Office

JERRY WIENS, Energy Technology Development Division

Consultant to the California Energy Commission

WALT LOSCUTOFF, Ph.D.

ALSO PRESENT

(Alphabetically listed)

TONY ANDREONI, Air Resources Board, Research Division

ROGER A. ANDERSON, Clean Energy Systems, Inc.

DAVID ASHUCKIAN, California Air Resources Board

JOSEPH BLAND, inventor

MITCH BORETZ, Center for Environmental Research and Technology
College of Engineering, University of California, Riverside

NORM BRYAN, Electric Vehicle Association of the Americas

DENNIS CHAMBERS, Allied Signal

JAMES J. COLE, Southwest Research Institute

STEPHEN E. DOYLE, Clean Energy Systems, Inc.

RICHARD A. DUSTE, U.S. Electricar

JOHN EASTWOOD, Trinity Flywheel Power

ALSO PRESENT, continued
(Alphabetically listed)

JOHN T. GUERIN, AeroVironment Inc.

JONATHAN HAINES, Toyota Technical Center, USA, Inc.

MARCEL L. HALBERSTADT, Ph.D., American Automobile Manufacturers Association

GERALD HALPERT, Ph.D., Jet Propulsion Laboratory

JACK KITOWSKI, California Environmental Protection Agency,
Air Resources Board, Mobile Source Controls Division

MARK KRAGEN, Calstart

W. A. LUSBY, Northrop Corporation

JASON MARK, Union of Concerned Scientists

CECILE M. MARTIN, California Electric Transportation Coalition

PAUL NORTON, National Renewable Energy Laboratory

GLENN D. RAMBACH, Desert Research Institute

KENNETH D. SMITH, Mathanex

J. RAY SMITH, Ph.D., Lawrence Livermore National Laboratory

ALEX SPATARU, A-DEPT Green

ARTHUR SWEET, Goremotive Industries, Inc.

JAMES P. TAYLOR, Clean Energy Systems, Inc.

GREGORY E. VLASEK, California Natural Gas Vehicle Coalition

WEI-MING WANG, Delphi-E

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Advanced Transportation Technology Stakeholders Forum, November 21, 1997

Friday, November 21, 1997 9:03 a.m.

P R O C E E D I N G S

MS. DELLER: I'm Nancy Deller, and I'm head of the Energy Technology Development Division. And part of Division Programs include the Transportation, Technology and Fuels Office, in which the TETAP Program is located. And I'm here today just to welcome you to this activity.

We've been working for a long time trying to improve our TETAP process, our Transportation Energy Technology Advancement Program process. And we wanted to make sure that we were involving all the people who are stakeholders and have an interest in making sure this is a successful activity, so we've invited you here today.

The purpose of our meeting today is we want to go through the solicitation process that we have and to work with you to identify the things that we can do to improve that process.

We have hired a contractor who has interviewed a number of people, some of which may be you. And he has given us some insights on what the stakeholders he has spoken to think are the problems and the issues that we need to deal with in making the TETAP process more accessible, more user friendly, more effective.

And that's one of the purposes in our meeting today is we'd like to get

your input on the issues that have been identified and to see if you agree with the issues that have been identified, if there are other issues that we need to focus on and change in order to be able to work with you more effectively.

That's one of the items we want to talk with you about.

The other is that we want to focus on what technologies should we focus the TETAP Program on? What transportation technologies should we put our efforts into? And we've identified some. We want to get your reaction to that and to identify what the critical issues are that are associated with those technologies so that we can target, to the extent possible, what we do so it can be more effective.

I'll put up the Agenda for today's meeting and then introduce you to the people here from the Energy Commission.

I think we have an ambitious meeting Agenda today, but I think we'll be able to get through it.

As I said I'm Nancy Deller, I head up the Energy Technology Development Division. In the audience is Susan Brown, in the red jacket, who heads up the Transportation Technology and Fuels Office. And to my right is Dan Fong, who's our Senior Policy Analyst for the Transportation Technology and Fuels Office. And then we have various Staff who are also in the audience. Avatar Bining will be presenting some information to you today, as well as Walt

Loscutoff.

Is Walt here? Hi, Walt.

So with that, I'll go through the desired outcomes for today's meeting just so that we can all understand what we're trying to get out of this. We're trying to make sure that we understand all the stakeholders' roles; what role we all play in trying to develop transportation technologies, and how we can effectively work together?

We want to give you an overview of our TETAP process so that you understand what we use to evaluate proposals and the process we have to go through in doing that. We also want to identify all the advanced transportation technologies that we should be focusing on. And then we want to talk about how we can work with you more effectively to make it a positive experience for all of us that has significant results.

So with that I'll turn it over to, I guess, Dan.

MR. FONG: Thank you, Nancy.

Well, it's good to see a lot of familiar faces here. I'm glad that all of you have taken the time and made the effort to attend today's forum.

The topic of my short discussion here will be the role that the advanced transportation technology stakeholders' group can play in our endeavors to resolve some important technical barriers on technologies that we believe are

important for California's long-term future.

We've invited you and the organizations that you represent because we believe that you have knowledge, expertise and resources that can be used to address technological barriers of various technologies that we think can really improve California's economy and long-term environment.

We've brought you here today to begin a process of information exchange, to build teams and collaboratives that can marshalled, along with our assistance, to work in resolving many of these important technological barriers.

We also believe that you, in your organizations, are the implementors of many of these different potential technology projects. We want to be able to work with you as an equal. But because we know that you may have a different perspective than ours, we want you to give us that feedback. How are you approaching the resolution of some of these technical barriers? How can the Energy Commission cooperate with you as a team, you know, to make progress?

We want to hear from you on what technologies merit Energy Commission support, what are those key barriers that prevent those technologies from being a commercial product in the marketplace?

We also would like direct feedback on today's presentation. What is it that you will hear today that makes sense to you? What do you hear today that doesn't make sense to you? You have an opportunity to really influence how we

proceed with our solicitations for technology R&D.

We may not entirely agree. But then again we're hopeful that there is going to be some important consensus reached so that, when we do release our solicitations, you'll find it beneficial and so will we.

Long ago Benjamin Franklin was quoted as saying, "Sometimes it's better to remain silent and be thought of to be a fool than to speak out and remove all doubt." Well, hopefully today no one here will believe that we hold that belief. We want you to speak out. We want to hear your opinions on how we should be investing our resources in technology R&D.

Yes, we have some of our own opinions, but those aren't cast in concrete. We're willing to entertain new ideas and new approaches. But we also feel that there are some key technologies where we would like to make progress in, because again, we're trying to change California's dependence on petroleum, we're trying to improve the emission performance of all of these various transportation energy technologies.

We feel that those two characteristics are inherently linked together. That if California is to prosper, as a state, we both need to use our energy resources wisely, while at the same time we need to preserve and protect the state's environment. It would be a disaster, I think, that we have this tremendous economic boom and yet those individuals who actually would benefit from that

boom suffer from the environmental effects of energy consumption and use.

So I'd like to open it up for a few moments here, get some feedback from you on what I just said, whether or not you believe that we're taking this in the right manner. Are there specific roles that you have in mind that I may not have mentioned?

Anyone?

MR. RAMBACH: Yes. One comment on developing advanced technologies for transportation or energy. It's not always necessary to think that that stuff has -- that that technology has to be employed locally. As things progress over the next several decades, the developing world and the rest of the world will have to do repurchasing of remedial technologies, advanced transportation technologies, and you need to include in your portfolio thinking the fact that we can pervade this, that we'd be selling this overseas, for example. So that any new, you know, fuel cell technologies or advanced technologies can be sold in the underdeveloped communities as well as new energy -- as new energy opportunities.

MR. FONG: That's a good point. Could you identify yourself?

MR. RAMBACH: Glenn Rambach from Desert Research Institute in Reno.

MR. FONG: Thank you.

Yes?

MR. KEN SMITH: Ken Smith, Methanex.

Having been through this process before -- and I know you're trying to revamp it -- and having been very frustrated with the process before, I hope that you're going to reconsider the immediacy of commercialization in this program, because some of the technologies that are out there, especially fuel cell technologies, are going to take a little bit longer to develop. And the pressure put on by the need for commercialization and royalties and those sorts of things are just going to ensure that you don't get good technologies.

And so I think that to a certain extent, statutorily, you have some requirements, but on the other hand you have a lot of discretion to adjust those timeframes. And I know you were under a lot of pressure at the time we came into the -- when Gerry Halpert and I came into get the -- direct inhouse fuel cell technology, you know, applying here. But I think that really has to be taken into consideration, or you're not going to get through the projects.

MR. FONG: Yes. I hope that some of the things that you'll hear later on in today's session, Ken, will address the important point that you raised there. I think we are moving in a direction that you suggest. How far we can go, that's something we need to flush out internally.

But I agree with you, that in the past at least, some of the requirements

placed upon our TETAP Program were not very well received. And I can certainly understand why they weren't.

Now we're going to make some attempts to move in the opposite direction. That is make our process, as well as our funding, a little easier to accept for all of the participants that, you know, we want to partner with.

MR. KEN SMITH: That's what I found out, push the envelope again, that's what we need to do.

MR. FONG: Yes, Greg?

MR. VLASEK: I'm Greg Vlasek, California Natural Gas Vehicle Coalition.

We had a meeting similar to this, in this same room, you know, with a similar group of people, about six months ago. So it would be helpful, just for my edification meeting here, for the edification of others, to talk about what advancements we think have been made specifically since that meeting, and how this meeting is intended to carry on from that meeting.

Also I would just like to comment on your stated commercialization goal here, because I think it's important that we all have a clear sense of what CEC's -- it's important we have a clear picture of what that goal actually is from CEC's standpoint.

I notice you already mentioned energy diversification and displacing or reducing our dependency on petroleum. But your goal statement doesn't say

that. It says you're looking to commercialize technologies to reduce fuel use, which to me means increasing fuel efficiency, or increase the efficiency of the transportation system, or to reduce emissions. So I hope to hear, fairly early on in the proceedings today, some clarification then.

MR. FONG: Yes. I think you have a good point there. And I also commented on that to my staff, or to the people that I now work with, that we need to be a little more clear on that particular statement. Yes, we are focused on transportation technologies that really displace petroleum use; that's one area. Now that could take the form of more efficient technologies, but also in the form of alternative fuels.

We recognize that most of the alternative fuel options are not as efficient, and are not as reliable, or durable, as competing existing technologies. And so this program will try to make investments to improve the efficiency of those alternative fuel technologies.

Any other questions or remarks, based upon this subject of what your role can be, or what you see your role as being?

Yes?

MR. ANDREONI: Tony Andreoni, from the Air Resources Board Research Commission.

From the last meeting, since that was brought up, there was a marketing

group that was involved with evaluating the TETAP process. Has that been finalized and is that going to be discussed today?

MR. FONG: Yes. You'll hear some of the recommendations or issues that have been identified by that consultant firm. And, in fact, let me get back to a little bit of Greg's earlier question, is that today's group is a much broader set of individuals and organizations. The earlier meeting that we had tended to focus on sort of the academic and industry technical sort of expertise.

We were trying to, at least at that stage several months ago, really help us focus on the different technologies that we might focus on. Now we're bringing this to this wider group of stakeholders. Basically you'll hear presentations this afternoon on the sort of technology areas that were highlighted in the previous meeting. And subsequently we've also identified some additional criteria, I guess, that we would like to focus on with our solicitation.

Any other comments?

Yes?

MR. LUSBY: Art Lusby, with Northrop-Grumman down in Los Angeles.

We're building an advanced technology transit bus. That's an experimental bus right now. And one of the things that we had as an objective from the start was to try to develop an alternate fuel vehicle that cost at most the same price as a competitive product.

And it seems to me one of the things that's inhibiting alternate fuel vehicles is the overall system cost of them. And so we're trying to develop one that is no more and may be even cheaper. So I think that the cost is a major element in getting these into production and into the systems.

MR. FONG: Yes, we would agree.

Any other points that you'd like to make, none to the group as a whole, just to stimulate some thinking and discussion?

(No response.)

MR. FONG: Good. I appreciate the comments that we did receive. I thought all of them had merit, and we would like this sort of dialogue and interchange to continue throughout the day. We believe that you folks can be the nucleus of important teams and collaboratives that together, along with some assistance from the Energy Commission, you can make some real important progress in this area of technology advancement for a variety of transportation alternatives.

Yes?

MR. SPATARU: My name is Alex Spataru, on the A-DEPT Green.

A lot of these projects may require a prolonged participation. You're looking at programs that may require more than a year to come to a commercial fruition. Certain programs, like this vehicle program, for instance, has a format

that allows gradual increased participation if the actual project turns out to have merit, that the technology is proven to have initial merit. So it's a go-no-go-type program where you have a look-see, does it make sense, does it not make sense? If it does make you drop it; that's good. You allow it for a greater participation.

There doesn't seem to be this kind of continuity in TETAP. Is that intentional, or is it meant to be a hit-and-run-type program, or does it allow -- I didn't mean that in a negative sense -- is it meant to be a once-in-a-lifetime-type opportunity, or is there room there for a continuous involvement as a technology advances, until it becomes at a point where it goes on its own for commercial purposes? Do you follow the gist of what I'm saying?

MR. FONG: Yes. I think what you're saying makes very good sense. It's something that we've actually done in the past but not necessarily through our TETAP Program. TETAP intends to focus on those early R&D technical barriers; that's correct.

But there are other elements within our transportation development program which hopefully will take that development if it's successful, and then go along what I call a continuum of different phases for technology development and commercialization.

Yes, there's an appropriate timeframe where R&D, and resources for R&D, need to be invested. And if that R&D proves that that technology has some

long-term potential commercial merit, then we will try to nurture that and make additional investments to bring it to the market.

But some of our problems in the past, in really fulfilling that goal, is basically a funding issue. We basically go on a 12-month cycle for our funding. And for those of you who have experienced the California state budgeting process I think you recognize that it's not necessarily a process where a lot of rationale and consistency is forthcoming from our elected leaders. I guess that's part of the playing field that comes with the territory.

And we recognize that our funding hasn't been as consistent as we would like. We're going to do everything that we can to improve that. You know, we're raising this internally with our management. And hopefully the organizations that have oversight over the Commission's budget will recognize that if the state really is serious about supporting some technologies and investing in those technologies, for long-term state benefits, then the funding has to be established at some reasonable level with some consistency, some dependability.

And so I think your remarks are very accurate that, you know, if you really are going to be successful in bringing some of these technologies to the marketplace, where they can be self-sustaining, then the state also needs to ensure that some level of support is provided those technologies. Not just once

in a lifetime. And not just during a certain stage or phase of its development.

But once we make an investment our hope is that that investment leads to long-term commercial success. And we'll continue to try to make those investments along that development path to where that product can be competitive with existing products.

You know, we don't believe in sort of a lifetime of government support, but we do believe that in those early years where the playing field may not be level, where the entrenched sort of technologies have, you know, sort of significant advantages over these more beneficial technologies, then we will try to overcome those disadvantages with supportive measures or initiatives that we have some ability to create.

Do you have a follow-on question?

MR. SPATARU: There was one point here that I don't think was addressed. Part of the TETAP's function, as I see it -- and I'd like to be corrected, if I'm wrong on it -- part of this function is to essentially act as a high-risk bank, as a high-risk state bank, because the funds are repayable. And, as such, you shouldn't be subject to the vagaries of the budgetary process of the state of California.

If there was a real commitment to this kind of an investment, then there would be a set-aside. And that set-

aside would be immune to the budgetary process.

And, second of all, that set-aside would create its own inertia because if, in fact, the investments were properly placed, it would create its own inertia and its own continuity.

And there's an argument for structurally redesigning the process to allow for a continual rather than an up-and-down. We should look at the history of what has happened. And I think that that should be addressed at some point.

MR. FONG: Yes, good point.

Any other comments?

MR. ADDY: Just a program proceeding note. I'd like to encourage the participants to please hold up their hand and wait until I bring this microphone to them before you speak, because we're attempting to capture the comments that you make on the reporter's notes there. Thank you.

MR. FONG: Good. Well, we're pretty much on schedule. I'm pretty pleased so far with the participation and the very good comments that we've received so far. We're going to be moving along to the next item on our Agenda. And I think Mr. Bining will then carry this through for the morning session. And then I'll try to summarize at the end.

DR. BINING: Good morning, my name is Avtar Bining, and I'm Program

Manager of Transportation and Energy Technologies Advancement Program, in short called TETAP.

This morning I will be giving a complete overview of this program from its inception in 1992-93, and then walk you through this history of four or five years, of how this program evolved, what we have been doing, how we have been doing and what we plan to do in the future.

And all those issues that have been raised just in this morning's good discussion shows that there is considerable interest in this program. And people do take notice of this program for the sake of advancement of transportation energy technologies.

How many of you are familiar with TETAP? If you could, raise your hand? It seems like there is a fairly good number of people.

When I joined this program in 1992-93 we were having hard times in getting the proper sort of acronym of this program from people. People used to call it TIPTOP, TETOP, all kinds of acronyms. And I'm glad that over this period of four or five years people recognize this name, TETAP, which is Transportation Energy Technologies Advancement Program.

One comment that Greg made this morning regarding omission of ordinary fuels. There was no intention of moving that alternate fuel in our program, rather we wanted to see how our stakeholders recognize even of our

nonexplicit mention of alternate fuels. And when we say petroleum fuel use reduction, we are seeking all kinds of technologies that can achieve that objective. And there is no other better way than developing alternate fuels to achieve that objective.

This program basically is a public/private partnership program. And we focus on that, that we cannot do this thing alone. This a program that needs private/public partnership in such a way that we can achieve that goal that we have intended to achieve.

This program was initiated in 1992-93 Budget Act. The California Legislature provided \$2 million in petroleum violation escrow account to establish this program.

TETAP is a hardware development co-funding program designed to promote the research, development and demonstration of advanced transportation technologies. Through TETAP the Commission has provided qualified companies co-funding for a variety of advanced transportation technologies R&D projects.

The ultimate goal of our program is commercialization of those technologies that we are developing. And this commercialization of these transportation technologies would reduce fuel use emissions while remaining cost competitive with existing fuel choices. To enable new technologies to be

viable options they need to be thoroughly available to development and demonstration to prove their viability, performance, cost-effectiveness and consumer acceptability.

Additionally, investments in new transportation technologies development will revitalize California's economy and improve Californians' environment.

Since 1992-93 we have been getting funds from the Legislature almost every year except in the year 1996-97. Our annual funding has been on the order of \$1- to \$2 million. And this year, in 1997-98, we have \$2 million allocated for this program. And that is the money that we would like to use to co-fund projects in our next solicitation.

Many of you are aware of our program, of how it works. But I will quickly walk you through that whole process, which probably takes more than eight to ten months for us and for you to get those funds. But I will give you that quick, run through that whole exercise in probably in less than two minutes.

This program starts with we starting with our request for proposal preparation after discussing with various stakeholders the technology focus and the process that we want to use. And in the past we have been evaluating solicitation requesting proposals on the best innovations from the private and public sector to advance the state of the art of transportation and energy

technologies applicable in California.

Then once we get those proposals, we evaluate those proposals on the technologies to determine the best opportunities for California, using a selection process which is based on technical merit and policy merit.

After we select those qualified projects, we provide co-funding, up to 50 percent, to the most promising innovations where such assistance is most needed to commercialize a technology.

TETAP funds are used to leverage match funds from other sources. And typically other points are in the range of 15 to 20 percent of the total project cost. And we like to maximize the participation of other agencies or other entities to co-fund those projects.

Then an essential feature of our program is repayment. The repayment of the Commission of other funds in the form of royalty based on gross revenue is required if the subject technology is commercialized.

Now again that commercialization part is important. And it is important from jobs, growth and economic growth in California, because this successful commercialization provides more jobs for California, leads to repayment of funds, allowing for the possibility of continued co-funding for future projects. And all TETAP awards are fully repayable if that technology is commercialized and generates revenue.

So during this process our first solicitation was released in 1992-93. We targeted demonstration projects that increase value by demonstrating an existing technology in a new application, or an existing technology using a new or improved complement or process, or demonstrating the integration of commercially available technologies into a new or improved technology.

And in that solicitation we allocated our funds to six technology categories that we thought were quite needed at that time. And ultimately we co-funded four projects out of those.

And the technology categories that we considered at that time are shown on this slide. As you can see, there is a wide variety of technologies that we presented in that RFP and solicited proposals on. And in addition to give some specific direction to prospective applicants how much funds will be available in each category. We tried that method in that solicitation that we allocated specific funds for those specific technologies, so that applicants can get some idea of what level funding will be available in each category. So we have been trying to that kind of approach. We tried that kind of approach in our first solicitation.

The four projects that we selected out of that solicitation were these. And all these four projects have been completed now. First was BAYTEC in compressed natural gas vehicle demonstration. And it was a very small amount, and it was one of our most successful projects.

The second was with Calstart to develop an electric school bus demonstration. And this project developed the first electric school bus in the nation, and I believe it was in the world, also. And this bus became a kind of model for developing an electric school bus by Bluebird.

The third project with Cummins was to develop an advanced diesel engine turbocharger. And that project we completed just recently. And we hope that that technology will be put to use in the next four to five years in heavy-duty diesel engines.

And our fourth project was an advanced flywheel project, which was funded with our Commission funds, and other participation was very small. And that project has also been completed.

Then we came to the second solicitation. And the second solicitation was released in November 1993. And in that solicitation we targeted research and development and demonstration projects that provided greater diversity of transportation energy sources by commercializing new transportation technologies, those projects that demonstrated and commercialized new vehicle propulsion systems and fuel technologies.

And we had about \$2.2 million in funds available for that solicitation. And that solicitation was our most successful solicitation in terms of getting response from the applicants, in terms of quality of those projects. And out of

the total projects that we had received here for evaluation we could select actually ten projects. And we were having funds for only six. And we funded those six projects.

And the reason for that was it was the second time -- the first time that many people did not know about our solicitation, about our program. The second time they knew about our program and so there was good response, and we were very happy with that.

The technologies again, the range of technologies, you will be surprised again, that we asked for in that solicitation was also quite diverse. You can see there is a great diversity of all those technologies that we were seeking. There were electric vehicle technologies, heavy-duty alternate fuel vehicle technologies, efficiency or emission improvement technologies, advanced fuel production technologies or fuel additives. And we are going to include some light or ultralight vehicles' projects or technologies there. And those projects that we funded out of this solicitation were these.

Three of these projects have been completed and the other three are still going on. And they are very much close to the finish line. Among these six projects, one of our projects was to develop a thermoelectric heating and cooling system for electric vehicles or automobile seats. And you can see that hardware here, outside, displayed in our exhibits. And those seats are being evaluated by

all major auto manufacturers to be integrated into their vehicle designs.

Another project on conversion of United States Postal Service vehicles. That was against a very good niche market for electric vehicles. And we got very good performance out of those vehicles. Those were actually conversions rather than ground-up designs. But we proved that concept that electric vehicles can work in those kinds of specific applications very successfully.

We have been demonstrating electric shuttle buses. We have been developing a 44 Electric Townsend Bus that is actually a hybrid electric bus. And we are working on developing an advanced compressed natural gas engine with T-

cogen (phonetic) that was meant to improve the fuel efficiency and emissions.

So this was our second solicitation.

And then we came to the third solicitation after some gap of about more than two years. And this solicitation we released in 1996. And we have only \$1 million for that solicitation. Again we targeted development and demonstration projects that included an existing technology in a new application, an existing technology using a new company process, the integration of commercially-available technologies into new or improved technology and demonstrating a technology that has significant potential to become commercial due to the proposed demonstration.

We received 11 proposals. But nearly half of those proposals could not meet the eligibility criteria, which included like match funds or some other administrative requirements. And we were left with only six proposals, out of which we found that there was not very good focus in any of those proposals on our specific goals or objectives. So we had to cancel that solicitation so that we can focus on another program, on another process, another overall co-funding mechanism of these projects in such a way that those funds can be used in a better way.

And again you can see the technologies that we mentioned. We even gave preference to certain technologies so that we can focus on specific technologies that we thought would be needed during that time. Very few people took notice of that, and very few people focused on those technologies.

Let me give you again the highlights of the ETAPs, that I have already mentioned. We have done some work on electric and hybrid electric vehicle technologies. We have worked on energy efficiency improvements and emission improvements and fuel technologies. And we have worked on alternate fuels.

And we talked of allocation of those funds in different categories. The bulk of our funds were used for electric and hybrid electric vehicle technologies in the past. Some emphasis was on emissions and alternate fuels. But again we were

dependent on the proposals that we were getting, and those funds were allocated that way in terms of what projects were selected out of what we were given by our applicants of stakeholders.

So we have to do some soul-searching here after our third solicitation. And we started thinking about our future TETAP. The Commission has full commitment to continue funding the development of advance transportation technologies to overcome technical barriers. And that can also be used the other way, that we want to continue funding to overcome barriers to the development of advanced transportation technologies.

We wanted to revise the TETAP process. And we started that revision process at our last meeting in June in the form of an advanced transportation technology group where we discussed a number of those issues. And we also contracted with a company, New Point Group, to do the evaluation off of our TETAP process. And we completed that evaluation last October.

And today we are here, on November 21st, as advanced transportation technologies stakeholders. And we will seek your input on those issues and on those technologies so that we can develop future TETAP. And that is the crux of this meeting, that we need your participation. We need feedback from you. We need your total commitment to move as partners in this TETAP process, program and future plans.

And after we get your feedback, we have to put together our next solicitation in whatever process that comes out with your feedback with our statutory requirements. And we want to use over \$2 million for this solicitation as effectively or as best as we can. So we need your feedback.

And our proposed timeframe for release of that solicitation is early next year. So there is not a whole lot of time left. We will have to move very quickly on this one. So this is a complete overview of TETAP, starting from 1992-93, what we have done, what technologies we have focused on, how much funds we have spent, how we have spent, what success we have achieved, what difficulties we have faced, how we want to move further.

And so we are at this point now. And at this point I would like to come back to the issues of that solicitation process again. And based on our TETAP evaluation by New Point Group, we identified seven issues, some of which are short-term, short-term in the sense that we feel that if we want to take some action on those we can take action that quickly, or we need to take that action quickly, and move forward.

Among these five short-term issues there are some that we can do; there are some that we cannot do, or some that we can modify in some sense that it meets some requirements.

As you know, this MWDVBE participation requirement, it is a statewide

requirement. And we are required to meet certain statutory requirements there. And we participated in that MWDVBE end of those. So there is a statewide process going on to revise that thing, and we are constantly reviewing that progress of how it is moving.

The second issue is regarding modifying repayment for reasons. That issue is more at our Agency level. We are facing that issue, not only in TETAP, but in our other programs also. And we are working on that, how to overcome that hurdle, or how to modify that for reason, in such a way that it is not a barrier to those programs, rather beneficial to those programs. And there is a Commission-wide effort on that thing, and we are continuously working on that.

Then the third critical issue that, from our perspective, is that if we can implement a preproposal process, which came out of our discussions with various stakeholders, that instead of spending a whole lot of money in putting together a complete proposal, which sometimes cost as much as \$10,000 or \$15,000, if there is a preproposal process in which we can give them quick feedback, and those proposals are brief, and that feedback can be used to improve the quality of those projects when they are submitted in full form in response to our solicitation.

And that process probably is one of the easiest for us to do, though on Staff

side there will be lots of additional work that will be involved, but we are willing to take up that responsibility.

Other issues like clearly identifying or articulating program goals and objectives, we can do that with your participation. And to market that program to preferred stakeholders, that is why we are asking or we are inviting you here so that we can see who are the preferred stakeholders. Naturally those people who do not take that much initiative to come in to our meetings, they may have probably less preference to our program also. So we are trying to implement that, too.

Among these short-term issues, I would like to open it for discussion here at this time, that among these five, if you feel that we have the proper identification of those critical issues, or if you can give us some feedback in terms of prioritizing those, I would like to open that for discussion now.

MR. ADDY: Let me just remind you to wait until you get the mic before you make your remarks.

MR. LUSBY: Yes, Art Lusby, again, from Northrop-Grumman.

I had a question on your minority business and women's business participation. Is that a firm requirement? Is that what number 4 is?

DR. BINING: Say it again, please?

MR. LUSBY: Is 4 minority and women-owned businesses, item 4?

MR. FONG: The answer is yes.

DR. BINING: Yes.

MR. LUSBY: Yes. I had a question: What is the requirement, and is it firm?

DR. BINING: Yes. The requirement is that whatever funds we provide for that project, fifteen percent, five percent and three percent of those funds should be contributed towards those businesses who have minority, or woman or disabled veterans. But it is a participation in the program in two ways. One is that is if you could find those businesses who can participate in your program of that project, and if you allocate certain funds to be used for those services that are provided by those companies, then that is the perfect example of meeting that requirement.

But then there is also another part which means that you make that good-faith effort to find those partners. And if, by chance, you find that you did not find anybody, or any of those businesses, but you still could document your good-faith effort, you still meet that requirement.

MR. VLASEK: Avatar, I'd like clarification on a couple of things, including not only this list but the previous programs that you've outlined. And I guess I have a number of items, and I guess I'll just go through them one at a time.

As far as the objectives and goals, I guess we're clear at this point that even though diesel efficiency was funded in previous programs, that would not be something that would be funded, given your criteria of petroleum displacement in future solicitations; is that correct?

DR. BINING: No, we will still be open to all kinds of technologies, including conventional fuels.

MR. VLASEK: Okay.

DR. BINING: Though our focus is on alternate fuels.

MR. VLASEK: Okay. You mentioned that you'd sort of summarize the success of the programs. But I'd like to have you elaborate on that, if you would, a little bit more. One, with respect to repayment, the repayment program, for any revenues generated.

I really didn't hear any characterization of the success of the various first and second solicitation programs. And I am only familiar with the BAYTEC project, which I think was, given the money spent, has proven to be very successful. But I don't know that any money has -- any royalties have been generated that would accrue back to the CEC.

Could you summarize the results of those with respect to any return to the CEC or to actual commercialization of a product?

DR. BINING: Yes. In our first solicitation our repayment requirements

were based on a net positive cashflow, that if there is a net positive cashflow generated by the business from that sale or commercialization of that product, then the repayments will trigger. And it was very hard to determine that net positive cashflow.

In our BAYTEC Project they have been selling this technology, the technology that was developed in this project. And also this effort in that project became a stepping stone to develop more advanced technologies. So we take it as a success from that angle that though, because of certain administrative requirements, or certain provisions, administrative provisions, we have not received any repayment yet, but the technology is already being put to use.

And there are some secondary benefits that all the other businesses in the state are getting in terms of some sales tax, some other revenue generated. But our main success is in actual deployment of that technology in the field. And we have some reports that we have been getting from BAYTEC that this technology is being used. And people are satisfied with that product. And the technology is making further progress.

The second project I can think of is our electric school bus. In the second solicitation of our repayment provisions were slightly changed. And there we asked for some percent of gross revenue. And that was based on some royalty basis. And we changed that provision from net positive cashflow to generating

gross revenue.

And there were specific terms and conditions that we had to negotiate with each contractor at that time. And we have not received any repayment so far from any of those projects that we have funded. But we do know that there is some success in advancing that technology and deploying that technology.

MR. FONG: Avtar, I'd like to also comment.

I'd like to make it clear that the Energy Commission Staff does not necessarily equate project success with repayment. Repayment was a policy requirement placed upon us by those who approve our budgets. We recognize that the true value of the investments that we make, through this program, comes from the successful deployment of these technologies, not in the potential revenues that are generated, and the potential revenues that come back to this program.

And even though there's some emphasis on the process for repayment, that is really not a primary issue or goal from our investment perspective. Yes, the state of California, who made these moneys available, would like to see some of this money returned, if there is financial success for the participants. But from our Staff perspective that is not a primary success point for our projects.

We know, though, that some of the repayment constraints make our program less attractive. We want to eliminate as much as we can some of that

unattractiveness that is related to this issue of repayment. But I just wanted to make sure that Greg understood that, you know, our successes are not dictated upon repayment.

MR. VLASEK: Yes. I understand that. I know you guys have struggled with the repayment issue, figuring how to make this process work. I guess what occurs to me, one way to approach it would be to have -- if there's a way that you could make the repayment in a preferable, preferred benefit of a program in your project criteria.

Again I think the real bottom line is identifying and articulating the goals, the objectives and the criteria. And if part of your criteria is to have that you would prefer to have some sort of contractual agreement for repayment of commercialized technology that would be attractive from the standpoint of the Commission, but it should be clear, if it's not a requirement of a proposal, then it should be clear in the solicitation that you don't have to submit that, but you will get favorable consideration if you do submit that. You know, to me that's part and parcel of making it as simple and straightforward a process as possible.

MR. FONG: Our current understanding of the requirement, imposed upon us, is that the Commission does have discretion on the form of repayment. Now we are working on other options potentially to provide even greater flexibility on the question of whether repayment is even a part of any particular

investment that we make.

But our current ability, I think, or our flexibility is in this establishment of what exactly constitutes repayment. So there is some flexibility there. And we're going to push that as far as we can so that project participants don't feel that they're being penalized if they're successful. And that fact is one of the reactions that we got from our New Point consultant in that those entities, who felt that they were successful, were then being penalized because other entities were not successful. And that's not what we want. We don't want those successful projects to feel that they're the only ones carrying the financial burden for program success.

MR. VLASEK: Since I've got the mic, I'd just like to make a comment about BAYTEC. For people who might not be familiar with it, and this is a little bit of a plug, but BAYTEC is not a member of my -- I don't represent them in any way, and they're not a member of the California NGV coalition. But BAYTEC is a company with a net worth of under \$2 million. And yet, partially as a result of the TETAP Program, they have successfully certified a low emission natural gas engine as an OEM product. So I'd venture say they're probably the smallest OEM engine manufacturer, certainly in California, probably one of the smallest in the United States.

But because of the successful experience they've had through TETAP, and

working with United Parcel Service as a partner, I think it's clearly a success story for the TETAP Program, and for BAYTEC, that with the amount of funds that were leveraged, you've now resulted in a production OEM low emission natural gas engine. So our industry is very proud of that.

DR. BINING: Thank you.

MR. SWEET: Avtar, I'm Arthur Sweet, from Goremotor Industries. And this is the first meeting of this type I've been to. I'm here from Southern California.

How does your ETAP Program tie into tie in with the federal SBIR grant, energy grant program. And also how does it tie in with the federal Energy Department; is there any connection at all?

DR. BINING: Yes, there is some connection. One is that these funds that we get, these are petroleum violation escrow account funds that come to us through the Department of Energy. Those funds come from the federal government to the state government and then the state Legislature allocates those funds to those parties who were requesting funds from that account. So that is one connection.

The second connection is that we like to see participation from other entities in various projects. And if there is some federal funding involved that is given credit for match funds.

The third connection is that we always keep in contact with other agencies in terms of looking at their programs, their projects, at what kind of technologies they're focusing on. And we steer our program in those directions.

In most of our programs, projects, there is a good amount of participation of DOE and some other entities, as well. And we like to seek more and more participation of federal funds or federal programs.

MR. LUSBY: Art Lusby, with Northrop-Grumman.

Just a quick question: Are the results proprietary when you do them under these kind of contracts?

DR. BINING: Yes. In our standard agreement there are some provisions for the confidentiality, debtor rights, and proprietary issues. I do not have those specific details at this moment. But as far as I know, most of the time the contractor has those rights to file patents, or rights to the proprietary information. But the state has a right to use that product for the welfare of the state or for the welfare of the public. So it is somewhat -- put it badly -- but certainly there is a good amount of proprietary rights that stay with the contractor.

MR. FONG: However, confidentiality is not an automatic option. The applicant does have to apply and make it very clear why confidentiality is necessary. Keep in mind we are a public agency. Public money is being spent on

these projects. And there is some expectation that the information generated from the state's investment is then going to be made available to the public.

But there are instances where we have been able to provide confidentiality and protect the proprietary nature of private sector investments. But there is a process that you have to comply with. And unfortunately my understanding is it is not necessarily a simple process where you simply state you require a confidentiality or there is some proprietary nature to the work that you want to perform.

MR. LUSBY: If the project were successful and if contracts were paid, the fifty percent up front, co-sharing, and then repaid all of the money at the end, he would have put all of his own money into it.

MR. ADDY: Now please state your name and your affiliation before you speak.

MR. MARK: Hi, Jason Mark, with the Union of Concerned Scientists. I wanted to highlight the need of the Energy Commission to focus its public investments on those technologies and options that deliver the greatest public return on that investment. And from my mind that sort of questions the role of diesel and diesel efficiency options in the slate of technologies that TETAP has funded in the past, but also in the future.

And as I'm sort of looking ahead towards the afternoon and flipping

through some of the technologies that the Energy Commission is considering for future funding, I just want to lay out on the table that we should really perhaps be questioning the wisdom of pursuing those strategies when we have a small chunk of funds. Perhaps we ought to be targeting them towards technologies and options that deliver the greatest social good for the investment.

MR. FONG: Could I clarify what you just said there? Are you suggesting that we not look at the scope of technologies that we are currently looking at, but instead limit that even further; is that your remark?

MR. MARK: Yes. I'm suggesting that if a diesel -- improving just the efficiency of a diesel combustion engine is on your list of possible funding options, which I think is the impression that I got, based on Greg Vlassek's question, then I don't think that's appropriate to be inside the scope of TETAP's purview.

MR. FONG: Okay.

MR. SWEET: Arthur Sweet. I don't know whether this is the time to bring this up, but I'm re-reading your TETAP coal commercialization. And there is a phrase in there, "while remaining cost competitive with existing fuel choices." In my basic opinion, this is one of the major problems that we're having in the alternate fuel development field and alternate technology, because, if you'll look at Europe, that has a very, very successful alternate fuel program

with natural gas vehicles. You compare them with ours, where the dedicated fuel vehicles are going to amount to maybe 15,000 units this next year. And the conversions, even though it's being supported, are maybe fairly substantial. But it's strictly the result of federal financial support credits that are available.

This is the essential problem, to expect commercialization, with all these new developments, in light of keeping competitive with existing fuel cost, I think you're asking for a great amount. I think that fundamentally your goal should be to develop new technology. And the idea of having it competitive with existing fuels is going to be -- apt to be let to the future.

DR. BINING: Do you want to make a comment on that?

MR. SPATARU: Yes, I'd like to make a comment.

Alex Spataru, of the A-DEPT Group.

This is a suggestion made to the Commission. I think that the mission should be one of looking at a portfolio of technologies, what you've essentially done up to now, where you have a portfolio of different risk projects, where you have some projects that have a longer risk, where cost-competitiveness would not be a high criteria, where you make allowances for that because you have to have the long-term perspective.

And, at the same time, you have to pay attention to existing technologies, like ACM, and see what you can do about helping people who are in a situation

to make those engines more efficient, to make them less pollutant and what-have-you, because sudden change is practically impossible.

So if you can help with a transition process in an intelligent fashion and a cost-effective fashion, that should be part of your portfolio as well. I think it's very -- I think it's well intended. But I think it would be a mistake to just say we are not going to fund an area that has proven to be a very cost-efficient means of transportation in the United States and in California. So that discretion has to be left to the Commission.

DR. BINING: Good point.

DR. HALBERSTADT: My name is Marcel Halberstadt. I'm with the American Automobile Manufacturers Association. And even though our members do not, at this moment, manufacture a lot of diesels, I would like to support what Alex just said, in that it's inappropriate, in my opinion, to prejudge the value of any technology that could come under development.

And it appears to me that one of the ground rules under which technology development takes place is that appropriate and applicable environmental concerns will be addressed. And it's totally inappropriate in that sense to exclude a potential improvement to an existing technology without considering it among all the others.

MR. MARK: Jason Mark, with the Union of Concerned Scientists, again.

I'll try to rebut some of the previous comments and just sort of clarify, to the extent possible.

First of all, I certainly would agree that the best way to guide the public investments would, in fact, be to set performance targets that we all agree upon are appropriate. And if, in fact, a conventional vehicle technology can compete in that market, that that perhaps makes some sense.

However, I have two responses to that reasoning. First of all, we're talking about a very small amount of funds. And we really, I think, have an opportunity through TETAP rather than other programs, which may create incentives for things like reducing emissions from diesel technology, through TETAP I think we have an opportunity to really set out the mark for truly innovative options.

Second of all, my concern is that in TETAP and in other funding programs we don't have a mechanism by which we can incorporate or capture the performance, the environmental performance targets that really are truly protective. In other words, how do we incorporate, for example, CO₂ benefits, or energy dependence benefits. How do we incorporate toxic emissions, something that Cal/EPA is currently pursuing through a regulatory process to identify diesel exhaust as a human carcinogen.

So it becomes clear to me that our existing process doesn't capture all of the

performance targets that would allow us to make smart environmental choices about our public investment dollars. And so given that inability, I would much prefer the TETAP Program to focus its emphasis on options that clearly deliver those types of gains.

MR. VLASEK: Greg Vlasek, California NGV Coalition.

I can never remember whether it's \$1 billion or \$8 billion that the automobile industry was given, under the Partnership for New Generation of Vehicles, to enhance efficiency of our light- and medium-duty vehicle fleet. The \$1 million or \$2 million a year we're talking about here obviously pales in comparison to that.

So I think it's fair to say the Energy Commission could focus, being that you do have the goal not only of efficiency, but of reduction of the use of petroleum, it would probably be fair to focus, as Jason is suggesting, on those fuels that really meet both of those goals and not get sidetracked into diesel technologies for light-duty automobiles, or your continued investment in diesel vehicles, or gasoline vehicles, for that matter.

MR. NORTON: Paul Norton, with the National Renewable Energy Lab.

I think it's important in a discussion of -- that the word "diesel" comes up quite often -- to make the distinction between conventional diesel fuel, and what's usually referred to as diesel engines, which are compression/ignition,

direct-injection throttleless engines.

And I think it's very important to continue to look at research directed towards diesel engines or compression/ignition engines, because they have a high potential for being high-efficiency engines for various fields in the future.

So when we're talking about whether to fund diesel or not to fund diesel, I think it's important to make that distinction. Although I would agree that perhaps funding projects out of TETAP for conventional diesel fuels is perhaps not appropriate; for diesel cycle engines I think it's very appropriate.

DR. BINING: Yes, good point.

MR. FONG: Are there any feelings from the audience regarding a preproposal process as being part of our solicitation award?

MR. EASTWOOD: My name is John Eastwood. I'm with Trinity Flywheel Power.

Clearly as a individual who works with a company that's developing advanced flywheels, my comments are inevitably somewhat prejudiced, but so are everybody else's, so I'm going to make them anyway.

I think that a couple of observations to be made, particularly by the representative from the Union of Concerned Scientists, which are very relevant, in that the amount of funding that's made available through the TETAP process is relatively limited.

And therefore I think that it's very important that the process, the process that we're talking about here, should identify novel and different means of propulsion systems that have the advantages of providing the opportunity for increased efficiency and obviously for cleaner air.

And therefore to invest money into such things as a diesel engine is a mere drop in the bucket. And I would suggest this is a wonderful opportunity to pursue new technologies which could contribute towards solutions, both in terms of efficiency, and also in terms of clean air, as I mentioned.

The other thing is Mr. Fong asked a question concerning the presolicitation process. I think that's a very good idea because I think what it does, it provides an opportunity for various interested parties to submit documents, whether they be white paper or whatever, which are then reviewed by the Commission.

And since Mr. Bining has indicated an interest and willingness on the part of the Staff to do that, that means that when the bidding process takes place there is already a prescreening. And I think that, as you said earlier, saves money on the part of the participants and helps to focus the effort. So I think it's an extremely good, productive idea.

MR. DUSTE: Yes, Rick Duste, with U.S. Electricar.

And we've submitted proposals in the past, one that was successful and one that wasn't. And as you're aware, there's quite a bit of work involved in

doing them. And we do a fair number of proposals with other agencies around the country. It's pretty common, either white papers or pre-proposals. So we so support that quite strongly. I think it makes a lot of sense, not only from our company's standpoint, but also from the Commission's, because you can get maybe a wide variety of ideas you wouldn't have gotten otherwise to select from.

You might also want to open the idea of allowing more than one preproposal from a company, because in the past maybe we had to select which item we thought we could sell you, so to speak. Where maybe we had a variety of ideas and maybe one of the other ideas was something you were more interested in.

MR. KRAGEN: Mark Kragen, with Calstart.

And actually I agree that the preproposal idea is an excellent one. My only caution would be to not extend the timeframe from application to actual funding too much further than it already is, because that is a concern that, you know, at what point do you get the money, especially if you have other funding commitments that are associated with the program.

MR. BLAND: Joseph Bland, B-l-a-n-d. I'm sorry I came in late. I just have a quick question. When you say, "market the program to preferred stakeholders," would you mind telling me what a "preferred stakeholder" is?

DR. BINING: The preferred stakeholders means that those people who

propose certain technologies that fit directly into our objectives and goals, and those stakeholders are fully committed to those kinds of technologies or projects. And if we get that feedback from those people, who are already committed to those projects, then we feel that those projects fall into other goals and objectives, then we can market other programs to those specific stakeholders.

MR. BLAND: Then I guess I need to have defined what you mean by "market," then? What do you mean when you say "market the program?"

DR. BINING: "Market" means to provide whatever information we can provide to them so that the program is accessible to them and it is not that --

MR. BLAND: Is this exclusionary at all? I guess that's what I'm trying to get to. Is it an exclusionary process that we're talking about?

DR. BINING: No.

MR. BLAND: Okay. It sounds that way.

MR. BORETZ: My name is Rich Boretz, from UC Riverside.

I wanted to get back to your question on preproposals. I think that's a excellent idea. I agree with Rick Duste's comment that more than one preproposal from an organization should be welcomed.

And one further comment is you might invite, in the preproposal, some sort of statement allowing the Energy Commission to disclose our preproposals to other proposers. And in that way there might be some match-making process

that wouldn't affect your impartiality, but might form stronger teams.

And, in our case, you know, the University, we're not in it for profit. We're just here for the knowledge. And if we could find someone who is in it for the profit that might improve achieving your goals, our goals and private sector's goals --

MR. FONG: That's an interesting point. In most cases the material that is submitted to our agency becomes public information, although we don't sort of, you know, go out of our way to duplicate it and then mass-mail it. But those entities who do have an interest can simply request of our Contracts Office to review those submittals. And in every case that I'm aware, those proposals have then been made available to those interested parties.

MR. SPATARU: Alex Spataru. Quick comment on preproposals. I think it's a great idea. You don't want to make sure -- at the same time you don't want to make it that, if someone doesn't submit a preproposal, they cannot submit a proposal. You want to make sure that you allow that door to stay open.

And if somebody wants to have a preproposal circulated among the other preproposer parties, they should simply check off a box saying that. Then you simply make that available. That's a great idea.

DR. BINING: Yes.

MR. SWEET: Art Sweet. The preproposal idea is an excellent idea.

However, I would take and limit the size of the preproposals to maybe a one-page, or two-page, or whatever you want to do. The same way I'd do that with the final preproposals when you do that. Because in other agencies in different fields, where we have submitted grant preproposals, they tend to do that. And it makes you concentrate your efforts in actually meeting the goals which you have, which you stated.

DR. BINING: Yes, that is what the intent is on preproposals that it should not be like a 20-page, 40-page document, because we will answer and have a hard time in evaluating that 30-, 40-page preproposal document. So our preferred approach will be something like no more than four pages or five pages.

Preferably one or two pages.

Any other?

MR. ADDY: McKinley Addy of the Energy Commission.

One of the questions that Avtar asked at the beginning of his presentation or somewhere in the middle there, was whether the list of issues that are posted up there on the screen that were identified by the consultant as potential barriers to the submittal of good proposals to the TETAP process, were issues that you in this audience identify with.

And I haven't heard any confirmation from anybody that these are some of the issues that would keep people from responding to the TETAP solicitation

and whether, if the Commission were to resolve some of these issues, it would encourage a greater number of you to respond to a future TETAP solicitations.

And I wonder if we can hear on that point from you?

DR. BINING: Anybody to comment on McKinley's comment?

MR. COLE: Jim Cole with Southwest Research Institute.

The RFP process that you guys do have is one of the most difficult we've ever seen before. And we make our living responding to proposals. And I think you've got most everything there.

But there was one issue, and I may be wrong on this, but it had to do with the people doing the work had to invest their own money. And that's very difficult for universities or nonprofit institutes to do. And I don't see that on there. So even if there was a commercial manufacturer putting 50 percent of the money up for a commercial product, if he utilized the university to do that, some rule of the people doing the work had to put in their own money. And that's difficult for universities and nonprofits to do that. And I don't see how that really affects the end outcome or the goals of the Commission on where the money comes from, as long as it comes from outside the Commission.

DR. BINING: Yes, there is that requirement that 20 percent of the match funds should be applicant's own contribution. And that provision or requirement has been there for quite some time. And the basic intent there is

that the applicant can show full commitment to that project. If there is no direct investment by the applicant, then sometimes it is considered that perhaps the applicant is not committed to doing that project.

But to me that 20-percent requirement, there are certain provisions of how you can meet those requirements. It is not a direct cash contribution. There are some other in-kind contributions that are granted towards that. But we are certainly looking at all those issues, and that is a good point to look at.

MR. KRAGEN: Mark Kragen, Calstart.

On that 20-percent required applicant match, what I would suggest is, if you're concerned about the commitment and perhaps not overusing government funds, that you just make it the 20-percent private match, nongovernmental match. And I believe that would perhaps satisfy the commitment concerns that you have and at the same time allow for nonprofits to take on these kind of work activities.

DR. BINING: Any other issue that you think can be put on this list, for short term, other than these?

Yes?

MR. FOLKMAN: Jim Folkman from the Energy Commission.

I just want to make a quick comment about communication and sharing information on the preproposal process. If that comes to fruition and a

preproposer checks that, there is the Internet that these proposals can be, you know, shared also.

And our preproposal solicitation and the final solicitation will be on the Internet on our Website, too. I just wanted to let you know that. And if you have a chance at lunchtime, we do have a computer out there where you can check out our Website. And it's pretty self-explanatory.

MR. BLAND: Joseph Bland, inventor.

Again, I came in late so it might have been covered, but has anybody spoken about the idea of rating or somehow looking at deep pockets having to pay back more than shallow pockets?

MR. DUSTE: Rick Duste, with U.S. Electricar again.

After thinking about it a little bit, I'd like to support Mark Kragen's thought there on the 20 percent, that it not necessarily be the applicant but just from the commercial sector.

DR. BINING: Yes. Regarding the different rates of repayment, yes, when we -- actually in our repayment provision, there is a range of that royalty rate, which is negotiable. It is not a fixed rate. And each contract or each project is negotiated on those repayment provisions that way. So if one applicant feels that a low rate is more suitable, then that is negotiable.

MR. ANDREONI: Tony Andreoni from the Air Resources Board,

Research Division.

I guess it's kind of easily, or not maybe easily defined, when you look at number one, clearly identify the -- articulate program goals and objectives, when you start talking about the repayment and when you start talking about commitment, as far as percent, and the amount committed to the project, with other agencies we look at -- for example, the ICAP Program. The reason for that amount is to show commitment to getting this product developed, demonstrated and on the market, versus research.

So I guess there needs to be a definition of what constitutes research funds and what constitutes or allows funding for further development.

DR. BINING: Yes.

MR. ANDREONI: So that bridge may allow the amount required to be needed in the project to be more defined.

DR. BINING: Yes, let me rephrase that. What you mean by that is that we should allocate certain funds towards the research, certain towards development, certain towards demonstration that way.

MR. ANDREONI: It possibly may be necessary for the fact that, if somebody's concerned about a research entity like Southwest where they are not for profit, they may not be developing the product. It may be a private entity that may have to take it over.

So there's a definite line between where research or prototype develops to further develop the product into the market itself. So that fine line may not be clearly defined in the beginning, but may be defined later, and that needs to be shown.

DR. BINING: Yes. We have been thinking about those kinds of allocations. But then our main concern was that our total amount is so small that, if we start splitting it further, then our contribution in each of those areas becomes even smaller. So that was of our only concern there. That is why we wanted that whole part available to all kinds of innovative ideas. And wherever that innovative idea fits into that later in their research, or in development, or demonstration, it should be able to come into that program.

But certainly there could be some consideration for those kinds of projects, like we talked earlier, that if it is for technology advancement, where it is a long-term, there can be some consideration for that that way. And naturally that perhaps falls into more research and development than demonstration and commercialization.

MR. SPATARU: This is a request for a clarification. And I'm making an assumption. I want to make sure this assumption is a good assumption or if it needs further clarification. The assumption is that this is a California Energy Commission program, strictly a California Energy Commission program. And

being a California Energy Commission program it must follow the Mission of the California Energy Commission. And that Mission, the last time that I -- maybe, you know, I don't know -- my understanding of that Mission is that, number one, it must reduce fuel dependency, traditional fuel dependency in California.

Okay. And that is to be achieved in two classic fashions. Number one, conservative moves the existing fuels. And, two, encouragement of other fuels to displace existing fuels. And I'm not giving any priority to one or the other. But these are the two essential objectives of the Mission, stated by the Mission of the California Energy Commission.

So my clarification, the question that I have, is: Are these two criteria the primary criteria that are used in evaluating the merits of any proposal that is submitted under TETAP?

DR. BINING: Yes, they are.

MR. SPATARU: Okay.

MR. FONG: Yes, I would agree with Avtar's response. Those are the important two attributes in these projects that are submitted to us. There is, though, sort of an important balance that obviously we want to see technologies that are commercialized that also don't degrade the state's environment.

Yes, we can reduce petroleum consumption. But at the same time

whatever technology we choose to develop and try to commercialize, we then don't go into worsening the state's environment.

MR. SPATARU: Worsening the environment. There was one other comment which I wanted to make. Would it not be ideal if someone who's had a project that would meet both criteria at the same time?

MR. FONG: Yes.

DR. BINING: Even in some cases the technologies that have developed for conventional fuels can improve the performance of alternate fuels as well. So that is one reason why we'll keep that option open that, if there is that opportunity, then that should also be explored.

MR. KITOWSKI: Jack Kitowski with the California Air Resources Board.

And I just want to emphasize the -- obviously my opinions are biased, too -- the emphasis on emissions and the need for that. You do have that, I believe, as even part of the Mission Statement of the California Energy Commission, that a look towards emission is in there. And that's appropriate because we could obviously all go back and make systems that improve fuel economy but worsen emissions, they wouldn't be allowed to be sold.

And in addition many of the projects you're looking at will not be available for commercialization for years down the road. And we are constantly, constantly looking to lower those standards. It would not do much good to come

up with a system that's available for commercialization four years down the road but is only able to meet the current emission standards, because those would probably be outdated at the time. So there does need to be a strong look at the emissions impact.

DR. BINING: And also, as the name of this program suggests, in itself it is a technology advancement. And that is what we are seeking. In whatever way we can make that advancement that should be our goal. And it should not be at the cost of one benefit over the other, like energy efficiency improvements or petroleum displacement versus environmental issues. And the Commission is obviously very sensitive to those kinds of issues as well.

MR. CHAMBERS: Dennis Chambers, Allied Signal.

Avtar, you mentioned it took eight to ten months to evaluate a proposal?

DR. BINING: Say it again, please?

MR. CHAMBERS: Did you state earlier it took eight to ten months to evaluate a proposal?

DR. BINING: No, eight to ten months is our total cycle, starting with the preparation authority, to finally putting the contract in place. And during that time there are certain feeders that are essential, like we give up to about eight weeks to applicants to respond.

MR. CHAMBERS: I would like to recommend a point. Number 6, that

that be shortened, if at all possible.

DR. BINING: Yes.

MR. CHAMBERS: That seems like an awfully unusual extended period of time.

DR. BINING: Yes, actually that is a part of my other issues. If we are done with these more short-term issues, then I can move to those. So I see there is not any other issue that is coming out of this list. So we are focusing on these five issues. And within those five issues we are focusing on these three issues. Number two, which is quite obviously a sort of preferred issue by most of us. Second, is modifying MWDVBE participation requirements and part of modifying repayment provisions.

On the long-term issues, there are these eight issues that we have listed, that we have come up with. There again, there are some issues that we can easily deal with. And again they are on long-term basis that, as we are moving along, we will keep on making those changes, but the final result may not be.

So any discussion on these eight?

MR. BORETZ: Yes, this is Mitch Boretz from UCR.

A couple of comments on this is the -- most of the Energy Commission's research money is now going to be coming through the PIER program, the Public Interest Energy Research program. And there seems to be some confusion, or at

least not -- a decision not made yet on whether any of that money can apply to mobile sources and obviously the integration between things like electric vehicles and hybrid electrics and the utility grid.

So I don't know if you all have any insight on that. And I see you've also got -- aligning TETAP and ETAP and also establishing collaborative projects with other agencies. Yes, I think this issue of synchronization of funding and what you might recognize as co-funding, and previous funding, could come into play there.

MR. FONG: Yes. Let me try to throw some light on that issue. We are still internally trying to develop a clear policy on how the resources being made available for the Public Interest Energy Research program might be used for mobile source or mobile source kinds of technology, R&D projects.

I think one of the sensitive public issues, though, is that these moneys essentially come from electricity ratepayers. In previous decisions, issued from the Public Utilities Commission, on using ratepayer funds for research and development, there were some constraints placed upon using those kinds of moneys for transportation or mobile source related technologies.

Those constraints still exist. And the PIER Program will likely have to adhere to those previous PUC guidelines on how ratepayer funds are used for research and development projects.

We think, though, that there are some opportunities where certain kinds of dual application kinds of technologies, that both have potential for stationary energy applications as well as for mobile applications, could then qualify for support through the PIER Program. But that is still sort of an internal policy issue.

Our program here at the Commission in the transportation area is being handled by a different subset of policy individuals. We are, though, trying to bring to the attention of the responsible parties for the PIER Program where there might be some overlap and potential to take advantage of those PIER dollars.

But you're right, there is clear limitation, I think, on how we can apply the PIER resources to transportation programs.

DR. RAY SMITH: Ray Smith, Lawrence Livermore National Laboratory.

I guess I'd like to make a comment to urge the Commission to review in great depth that, because the coupling of the utilities with the transportation sector probably offers the biggest change in energy consumption that we see, either through production of hydrogen fuels, manufactured fuels, or electric vehicles, rolling storage if you will. It could markedly change the off-peak poor production efficiencies of the utilities and help all sectors.

And so the Commission needs to take a broad, systematic view of this potential coupling, because the leverage could be tremendous.

DR. BINING: Any other comment? Any other issue that needs to be put there on this list?

MR. BLAND: What's deregulation of the electric utilities going to do to the electric car potential industry, et cetera; anybody given consideration to that?

MR. FONG: Well, actually you can look at it as the cup half full or the cup half empty. I mean there are some positive developments with restructuring of the electric utility industry. There are now spin-offs from the regulated utility. And those spin-offs are now focusing on the future development and commercialization of electric vehicle technology. So that's very good.

It does have to be, I think, looked at from a business perspective, rather than to sort of take ratepayer money and then make that investment without any sort of financial risk is not necessarily a good long-term policy.

And so I think, you know, what we see happening in this restructuring overall is going to be a positive development. Where those entities, if they make those investments, then they seriously believe they're going to make money. And that's what we want. We don't want somebody who's got some money just trying to think about where to put it. We want investments that lead to long-term economic success.

MR. BLAND: Joseph Bland again. One type of electric vehicle, of course, is a hybrid in which you store energy and then release it. In effect, stored in a

battery, and then release it, or you can store it other ways. It seems to me that hybrid technology has some interesting applications to PIER-type technology.

So one possible route for somebody looking for funding might be to consider building or applying under PIER to develop a storage engine or an engine with electric storage, which could then effectively be also doubled with your type of a transportation program.

So that's one example, I think, where you could see a benefit coming out of PIER that could be applied your program as well. I'm looking at your number 11 on the thing, "Establish collaborative projects." And that that's just an example that comes to my mind, anyway, of one collaborative approach that might work.

DR. BINING: Yes, there are two areas where we think that that kind of stationary and transportation sector can collaborate on. One is on energy storage technologies that you mentioned, like flywheels, even fuel cells, to some extent all truck factors.

And the second technology area is on the infrastructure side, like charging, battery charging infrastructure. So we are exploring those dual application opportunities. And perhaps in our next solicitation we will mention that. And the same thing we feel that the PIER program is going to do, because there certainly is a benefit of taking advantage of that dual application.

With some of these technologies that are too expensive for transportation

applications now perhaps can be less expensive for the stationary applications and the experience gained from those stationary applications can be used towards developing more cost-effective technologies for transportation applications.

So that is the approach we are thinking of in the future, that those flywheels, if some of those bulkier flywheels, they can be cost effectively used in stationary applications as of this time. That is one way to go. And using those funds and demonstrating those technologies in stationary applications, and then experience gained from those can be used towards developing more cost-effective technologies for transportation. So that is the kind of approach we are thinking.

Charging infrastructure, that is perhaps easier than even energy storage technologies, because the utilities or energy suppliers have some vested interest in having more consumption of electricity in various applications. So they might like to collaborate on that more easily than on energy storage kind of technologies.

MR. VLASEK: Greg Vlasek. I have a couple comments on your long-term issues list, since you asked for that. Future solicitations being more consistent, I think that's critical to the longevity and success of the program. And I should mention up front some of these things tie in very closely to each other. I think having that consistent program with the anticipation that this will be an ongoing, you know, funding priority at the Commission, to have some

transportation technology advancement program is important. Simplifying the process and reducing cycle times, all these things are going to add value.

I mean, if you proceed with these, as you proposed them here, they're all going to increase the value and I think increase the quality of the projects that get submitted. Because people will know, for example, even if they can't make it a narrower application window, or they don't quite have their act together to apply in one cycle, they know that there will be another cycle the following year to do that.

The line in TETAP and ETAP makes sense. That aids the efficiency of the whole process. I think collaborating with other agencies would be very valuable. And I think there's probably some overlap of criteria or scoring mechanisms that may already exist like for the ARB Research Commercialization Program, for example. So there's probably synergies that can be derived, and possibly even some actual collaboration on projects that could be derived from that.

Institute of performance measure, I hope you plan to do that. I'd hate to have any program that had no measurement of its performance by any entity, government or otherwise.

Increase funding levels, sure, why not, to the extent you can find funding. I think if we've learned anything in past ten years, in this energy sector, is that there's constant opportunities and constant changes that can be effected towards

energy diversity and better air quality and efficiency through advanced transportation technology.

I guess the only thing I'm not real clear on is number 7, "Exploring the merits of an open process." And I'm not sure what exploration is required at this point to determine if that has merits or not.

DR. BINING: Yes. That issue has something to do with other contractual process or solicitation process. The open solicitation process, the way we are thinking is that we can accept proposals. Any time through the year anybody can submit any proposal at any time. And we keep on evaluating and funding those projects if they are worthwhile to fund and the funds are available.

But there are some pros and cons of that process that, if we get those proposals from people on that open timeframe, then, one, that we won't be able to target, specific areas that we want to, because one proposal comes at one time, and we evaluate that on one basis.

And then the second is a resource issue that how much Staff we will need to manage that kind for program.

And the third is regarding having equal opportunity to everybody. Like when we release a solicitation it is one time open opportunity to everybody to respond. Whereas, in this case some people may question that one applicant got more opportunity because of more resources, and so on.

So those are the kinds of issues which we want to explore before we expand on that.

MR. BRYAN: Norm Bryan, EVAA. I guess I agree with what Greg said about solving most of the long-term issues that are going to add value to your program.

One note of caution, though, on the collaboration area. You have to recognize if that isn't done really cautiously and doesn't really support the program, it's going to go significantly against 8 and 9. And so, you know, make sure that any collaboration that you bring into it is something where it's a clear added value and going to enhance the output, so that the extra complication in slowing it down doesn't offset it.

MR. SPATARU: Let's be finished with this sooner. Can we start on the other part, so we can have the break later, so we can maybe get out earlier today?

If we are finished with the items now, rather than take up --

DR. BINING: Yes, one comment that I would like to make on this one. As I mentioned, most of our funding so far has been coming from the petroleum violation escrow account. And that account is almost close to complete depletion. So we will have to seek some other sources of funds. And that is another issue that we wanted to explore with you, that if you have any other ideas, or other information regarding other sources of funding, we would like to

seek your input on at that, also.

MR. SCHWARTZ: Fred Schwartz, consultant to Trinity.

Anything you can do to reduce the time between proposal submission and the flowing of money would be tremendously useful.

MR. LUSBY: How long is that time?

DR. BINING: At this time it takes between eight to ten months.

MR. LUSBY: From the time the solicitation comes out?

DR. BINING: The time the solicitation is started in terms of putting together the solicitation, putting it on roll, accepting proposals, evaluating proposals, notifying selected applicants, and setting up contracts, eight to ten months.

MR. LUSBY: Thank you. Art Lusby, again.

DR. BINING: Anything else?

DR. RAY SMITH: Ray Smith, Lawrence Livermore, again.

In the reduction of the cycle time on the solicitations, you've talked about all the different steps. We understand that. What are the one or two major things that are causing the biggest hold up? Is it evaluation, or is it response from the applicants? What's the major hang up?

DR. BINING: Response time is typically eight weeks, from the date we release solicitation, and then a due date. That is about eight weeks.

And sometimes we had to extend that at the request of some people. When something happens and it was decided by the Commission that it is beneficial to extend that date.

Then from that time onward we take somewhere between four to six weeks to evaluate those proposals.

And then we take another four weeks to put it through our approval process from the Commission, because we have to take these selected projects to the business meeting and get full Commission approval on that thing.

And at that time we can notify the applicants that are selected. And applicants can start spending their match funds. But it is at their own risk at that time because, from that point onward, we send our contract documents.

And then the negotiations start, because some of the applicants, they may like to change certain terms and conditions. And there is a provision for that in that process that you can propose some terms and conditions that you would like to change. And that is the most time-consuming step. And sometimes that goes even beyond eight to ten months.

And we have been lucky that we have not been like some other programs, where it has taken like sometimes up to two years. But we have been able to set up our contracts within an eight to ten months window.

But we would certainly like to reduce that and the preproposal process is

one where the applicant knows about the project, and the applicant knows about the program terms and conditions. And if we simplify our process, perhaps it will be beneficial on both sides and we can reduce that time.

MR. VLASEK: Greg Vlasek. Yes. That explanation makes it clear to me how you get bogged down in the process. And at the risk of repeating myself, I'd say again that the criteria that you guys set up is, you know, really the bottom line for making this process work properly. And I think anything that involves negotiation is obviously going to involve some protraction of the time schedule. And that's going to work against the overall efficiency of the program.

So I'd say, I guess again, look real hard at your criteria and try and set up each step of what you want to get out of the program as a series of gates, to make sure that -- I mean, it really becomes a series of yes-and-no decisions as to whether or not you can work with a particular project and a particular proposal and try and absolutely minimize the amount of negotiation that's required in these things. I think that will be a big help in saving time.

MR. KITOWSKI: Jack Kitowski, Air Resources Board.

If I pulled the numbers out from what you're saying, though, an optimistic way of looking at it is from the point that -- and if I've got the numbers right, correct me if I don't -- from the Point A, applicants submit their proposal, to the time that they've heard that your Board or your Commission has actually

approved it, is only about three months. That's quick, you know, in some circles.

Now there's still hoops to go through. You've got to write the contract; you've got to negotiate that. And, yes, anything that can be done to reduce that is great. But for a state contract process, that's pretty good.

DR. BINING: Yes. We are shooting for somewhere between four to six months, if we do most of these things. And if we are able to do those, we can probably set up contracts between four to six months, easily, in spite of all those hoops.

MR. RAMBACH: Glenn Rambach, Desert Research.

On the issue of constraining your requirements for the review, you really can't -- in new energy technologies in research in that area, you really have to prepare to expect the unexpected. So you really can't overconstrain the criterion so that there's no -- you know, to really minimize the negotiation afterwards, you have to be prepared for quite a range of technology, as well as market issues, that you may not be able to expect ahead of time. So you have to leave that open.

DR. BINING: All right. I think we covered this prospect pretty well. And that was our part one of this meeting. And our second part is in the afternoon for which I will invite Susan Brown to speak.

MS. BROWN: Good morning. I'm Susan Brown, and I have the unenviable job of being the last speaker before lunch. And I'm going to make

my remarks extremely brief. But I do want to add my personal thanks to all of you for your constructive input this morning, because this is exactly the type of feedback we're seeking.

We've actually strayed, I think, from the morning topics into the areas that we want to stress in the afternoon, which are now on the viewgraph behind me.

What we're really interested in hearing from you this afternoon is input on the specific technology categories that are in the handout that we provided you. We're also very interested in comments, constructive comments, on the selection criteria.

One thing we don't want to do is duplicate the kind of projects that have either already been funded by other agencies or institutions, but we want to rather, as Dan has stressed on numerous occasions this morning, we want to form collaboratives.

So to the extent that as we go through the menu of technologies this afternoon, if you have information about other funding sources or available entities interested in co-funding with us, we'd certainly like to have that come out in the afternoon's discussion.

So I really don't have too much to add at this point. I think we have a choice here whether to begin discussion of the afternoon session for the next 20

minutes, or we can provide some time for you to examine the displays that the Staff have worked very hard on in the atrium, and come back maybe a little bit earlier from lunch.

So what's the pleasure of the group?

AUDIENCE PARTICIPANTS: Let's go to lunch.

MS. BROWN: Go for lunch?

AUDIENCE PARTICIPANT: Head for lunch and come back early.

MS. BROWN: Okay. Is that okay?

Then what I think we'll do is we'll adjourn the meeting right now with the promise that you'll be thinking about all of the technologies and selection criteria that we provided you this morning. And be prepared to come back at 12:45 promptly in this room.

So thank you again for being here. And we'll see you at 12:45.

(Whereupon, the luncheon break was taken from 11:35 a.m. to 12:50 p.m.)

DR. BINING: Good afternoon. I think we are ready for our afternoon session. Those people who want to leave early, probably they came early for this session, so we can take advantage of that.

So this is Part 2, specific technology approach for TETAP. And again, for the sake of the record, my name is Avtar Bining, and we are starting with the afternoon session.

Here I will take a slightly different approach from the way it is presented on that earlier sheet. And what I will do, I will go through a full set of those technologies that are mentioned in the handout, quickly, and walk you through those technologies. And then I will give you a little overview on our last meeting that was the Advanced Transportation Technology group meeting back in June.

And for the benefit of those people who were not present at that meeting, they can get some information on that. And then I will present information on selection criteria that was talked about at that time. And then we can open for discussion, and then focus on the selection of those technologies after covering of the selection criteria.

So the technology categories that we have listed in that, there are six categories. Ordinary fuel and technologies, electric vehicle technologies, natural gas vehicles, hybrid electric vehicles, advanced primary technologies, materials for vehicle and subsystems.

And there is more detail in that handout that I gave you in that package. And here under alternate fuel and technologies, we have listed some technologies that are in fueling infrastructure. So that fueling infrastructure technologies is more efficient, there is durable storage in terms of dispensing, blending, reforming the QFER standardization.

Engine vehicle performance in terms of power, torque, thermal efficiency, fuel economy, emissions, durability, reliability and some demonstration programs.

And in each of these slides I have highlighted some of those technologies, like these (indicating). There we feel that there should be some technology focus. So as we go along these different categories, you can take note of that, that this is our understanding that these are the technologies that deserve some kind of special focus.

In electric and vehicle technologies, advanced batteries, including lead/acid, nicad, like nickel metal hydride, lithium, polymer, thermal management of the battery packs, energy efficient electric propulsion systems, vehicle structures, charging infrastructure, because that is an important issue in the electric vehicle category.

Natural gas vehicles, engine performance. In natural gas vehicles all these technologies that we now tend to have like 10- to 15-percent power loss, relative to their counterpart engine. And again, 15 to 20 percent in the thermal efficiency penalty. So that is one critical area that we need to focus on.

Onboard storage tanks, they should be lightweight composite materials, safety, durability, reliability cost and standardization.

Fueling infrastructure, that is another major issue in natural gas

technology. We want that kind of fueling infrastructure. They're like a compressor, so they are high efficiency, low maintenance, long life, low cost and safety and reliability.

Hybrid electric vehicle technologies includes power trains. We have seen various combination of series, parallel, combinations of series and parallel, and so on. And we were having a hard time in sometimes getting the right definition of those series and parallel combinations.

Power sources, again advanced batteries, fuel cells, ultra-capacitors, internal and external combustion engines, using alternative and conventional fuels.

Demonstration of hybrid electric buses and trucks. In some cases these hybrid electric vehicles, they make better sense in medium-duty and heavy-duty applications. So we would certainly like to see those kinds of demonstrations.

Electronic controlled systems, both for power and for energy management, during operation and nonoperation periods. You know, one problem in electric vehicles we have faced often is that when vehicles are not operated on a continuous basis the batteries or battery packs, they tend to deteriorate, and we do not get full usage of those. So those kinds of management systems are needed there.

Advanced primary technologies, like fuel cells. We have been focusing on proton exchange membrane fuel cell for transportation applications because that

is what we feel that -- for transportation applications that this technology has an edge over other fuel cells, like phosphorus or solid oxide, or others.

Again, using hydrogen is very easy in fuel cells. The fuel cell part is very simple in that respect. And so we are interested in seeing direct use of hydrogen in proton exchange membrane or sort of a true reformer.

Alternate fuel, like methanol, ethanol. Perhaps methanol is more appropriate in near term than ethanol. Both have got it, a fuel reformer. And there are some discussions about using conventional fuels in fuel cells through reformer.

Flywheels, ultra-capacitors, both aqueous and solid electrolyte. We have some experience on aqueous electrolyte ultra-capacitors that you have seen outside displayed as one of our projects, our completed projects.

Emissions and efficiency improvement technologies. Lightweight engines that provide high specific power in terms of kilowatt power kilogram or power density kilowatt power liter. So those technologies.

Lastly, materials for vehicles and subsystems. There is some opportunity to reduce cost and improve performance by integrated structures, manufacturing processes, lightweight materials and demonstration of ultra-light vehicles.

So these are the six categories that we have kind of put together as a full landscape. And in your handout you see much more discussion on each of those

things. And those are the different points that you can review and comment on, or you can use that as a basis for your own analysis or comments.

During our last meeting of the Advanced Transportation Technology group we started evaluating -- or not evaluating -- but kind of considering these various technologies, based on the general focus at that time in that group and discussed general attributes of these technologies. And these are some of these examples from that discussion.

One item that was discussed was heavy-duty natural gas engines. Their positive attribute is on emissions. There is room for efficiency improvement. Cost is positive. Timeframe is kind of between positive and negative. Risk, there is some risk if seeking fundamental changes. Again, if we expect too much in too little time, like efficiency improvements, more power loss and those kinds of things.

And there were some comments that we're unsure if even a larger step in engine efficiency will grant either transition to this alternative fuel. The investment may be too risky. We can debate about all this in today's discussion.

The second technology that was discussed at that time was fuel cell technology. Again emissions are a positive attribute there. Efficiency is a positive attribute. Cost is too high, which is one area to focus on. Timeframe, maybe it is in mid term, long term, or in some cases maybe somewhere close to

end of the near term. Risk, again in some cases it is high, especially in the near-term timeframe. Again there was a cautionary note and may be applicable sooner in medium-duty applications.

Funding in the amount of \$500,000 may assist the development of biplate and membrane technologies, direct methanol and hydrogen fuel cell use. Common parts, that's sort of advances in one area, may impact others.

Then based on this kind of discussion there were four technologies that were suggested as our focus. Those were fuel cell systems. And the emphasis was supposed to be on cost reduction.

Internal combustion engine, electric hybrids. Emphasis should be on performance and reliability improvements.

Advanced batteries, subsystems. Emphasis with improving specific power and specific energy.

And heavy-duty low emissions engines and subsystems. Basically to improve emissions.

And there those technologies should be cost competitive. So cost competitive as well as cost effective, because most of these air quality districts, they have to meet that requirement of cost effectiveness. So if there is that kind of technology that is focused on reducing emissions, then that will be one emphasis.

And then the selection criteria that was talked about at that time, we came up with eleven points. But there was a small -- a little overlap in terms of selection of technology and selection of project. So due to that you will see some points that are specific to the applicant from that company or team strength, those kinds of things.

So with this background on our last meeting, we can now start from this point backward. We will talk about the selection criteria, also some additional points, and then move to the technology selection. The process for that, what we will use is Walt will have some opening comments, and then he will moderate this discussion.

And we will move on then. By the end of this part of this session, we will be able to select some technologies. And if we have time, we will try to shoot for some barriers to those technologies, so that we have some understanding of what those technical barriers are.

And if we have time we can probably talk about some specific goals in each of those technologies, or whatever technologies we can cover today. As an example of those goals, like in natural gas engine technologies, we can talk about; do we want to improve engine efficiency by 50 percent over the next four years or five years, or do we want to reduce the incremental cost of these engines by 50 percent in three years or five years, those kinds of goals.

So with this, I invite Walt Loscutoff to give some opening comments, and we will move on.

DR. LOSCUTOFF: Thank you very much, Avtar.

I'm not so sure you'd like to hear my opening comments, but I'll pass some anyway.

One reason you were invited here is CEC really does want to find out what is out there. I've worked with these people -- and I am a consultant, by the way. I do not work for the Energy Commission. But I've been consulting with them for five years almost now.

And so my job here, I was told -- I'm a professor -- and I was told not to talk too much, but just let you do the talking. So this will be conducted in the form of a workshop.

And one of the things we want to do is -- it's very, very important -- we do have good people here. There are very, very good people here. And they talk to a lot of people. They get a lot of inputs. And then they try to assimilate all these inputs and come up with the best program possible. You've seen an example of this right now. Avtar just passed on to you a lot of information, a lot of material that has been assimilated.

We'd like to go beyond that step. And the reason for it, the one very important reason for it, is that we would like to get high-quality proposals. And

a lot of proposals. That's been, I think, one of the problems that we haven't got as many as we want and so this is kind of a self-evaluation. We haven't got as many good proposals as we think are out there. So that's why we ask you: How can we improve the process to make it better?

It kind of reminds me of a conversation I had. This was about six months or so ago, I was talking to a friend of mine who works for a high-profile company, and R&D-type company. And I asked him why they did not submit a proposal on a particular area which fit them. And they should have been submitting a proposal. And the comment he made was rather interesting, and I'll pass it on for what it's worth. It is not a reflection on CEC, or anything else. It's just a comment. And he says, "In working with the CEC, it reminded him of a joke where a blind man walked into a Neiman Marcus store with a seeing-eye dog. He got in the middle of the store, all of a sudden bent down, grabbed the dog by it's tail, and started swinging it around. Of course, people started scattering all over the place. And the manager ran on over and said, 'Sir, sir, can I help you, sir? Can I help you, sir?'

"He says, 'Oh, no, no. No, thank you. I'm just looking around.'"

So with that, let's get started. And by the way, it's a requirement for any professor. You've got to start everything with a joke.

Okay. So for your benefit my name is Walt Loscutoff. And what I'd like to

do is, in essence, conduct a little bit of a workshop here. And rather than me doing any of the talking, have you do most of the talking, and provide us inputs, solid inputs. We'll try to evaluate it.

And what we'll do is cover two things. One is identify specific technologies. Avtar has mentioned a number here we've identified as being important to us and to the process of making California both energy efficient and also providing alternative sources of energy. So we'd like to have you identify, for us, specific technologies. And then also identify what are some of the barriers to commercialization. We'll go a little bit beyond that I hope today.

It's wide open. Although Avtar has mentioned four technologies, I'll mention them here. And these are the heavy-duty emission engines, fuel cell systems, advanced batteries, hybrid systems. But I added this other part, other, as this is completely wide open. It's what we would like to elicit suggestions from you, and comments from you, what you think is important for the state here.

You got to keep this in mind, by the way, is that the State of California ranks something like number seven in the world in terms of economy and in terms of -- the level of economy. In terms of energy, I tried to get the numbers. I think we're like number four or number three.

Yes, Sue says we're number three in the world. If we were a separate entity, a separate country, and you are looking at CEC right now, which

represents what really happens in the state, tries to provide guidance to the state in terms of energy. And you're looking at, in terms of energy, you're looking at something like 50 cents or three percent. That must be almost two million barrels per day. So there's a lot of energy that goes through the state.

But in any case that's got to be the importance of what we're trying to do here. It's not just a small pimple. It's a very substantial element in the world's economy and the world's energy consumption.

So what I'd like to do is conduct kind of a workshop over the next hour or so and identify various technologies. What I've done here is started -- by the way, I've identified several technologies here, just to get you started, in case you're slow in getting started. I'm not so sure you are. If you're in at this level, you've got a lot of ideas, lot of things you want to put that's expressly yours, so you might want to ignore that.

And I started here with a blank sheet and, in essence, a sheet for each technology. And I've also identified the various characteristics, the attributes. So I'd like to focus primarily on the positive attributes, and then look at the next part as the commercialization potential of these particular technologies and then barriers to these technologies.

And finally the last element; what must be done? Kind of specific things that have got to be done in order to bring it to quicker commercialization.

Now this may be a little bit too grandiose or perhaps too many of them; I don't know. That's what I'd like to get some inputs from you, even in this case. But, as a starter, we would like to go with that and then go from there. We do have our own -- some ideas here. We would like to get the ideas from you, what you think is really important.

So, yes, McKinley?

MR. ADDY: Just a reminder again that as you speak hold up you hand so I can pass this mic on to you.

DR. LOSCUTOFF: Okay. So in any case here we go. So maybe we need some questions or some ground rules before -- yes, John?

MR. EASTWOOD: I want to be a guinea pig.

DR. LOSCUTOFF: You want to be a guinea pig; you want to get started?

MR. EASTWOOD: I want to see how this thing works.

DR. LOSCUTOFF: All right. Let's get John up here -- yes, Alex.

MR. SPATARU: You've got this, which is 11 priorities.

DR. LOSCUTOFF: Right.

MR. SPATARU: Okay. And here you're trying to work from specific examples on technologies, --

DR. LOSCUTOFF: Yes.

MR. SPATARU: -- which I fully understand. It's a great exercise.

DR. LOSCUTOFF: Right.

MR. SPATARU: But if you don't have two or three items as the key priorities, how are you going to be able to evaluate those?

Am I asking the wrong question?

DR. LOSCUTOFF: No. But, on the other hand, in this case, what I was thinking is in terms of just starting with a blank sheet.

MR. SPATARU: Okay. Let's go.

DR. LOSCUTOFF: And then just --

MR. SPATARU: While keeping these in mind, right?

DR. LOSCUTOFF: While keeping these in mind, yes.

MR. SPATARU: Okay.

DR. LOSCUTOFF: After I gave them to you. But also I'd like to add one more caveat here. I'd like to take a Delphi approach to it. If somebody makes a comment, I would prefer that other people not denigrate the comment. In other words, feel free to make any comment --

MR. SPATARU: Everybody's holding, okay.

DR. LOSCUTOFF: -- knowing fully no one is going to criticize you.
Everybody's holding, you're right.

MR. SPATARU: Everybody's holding. So I want to see how the guinea pig works.

DR. LOSCUTOFF: See the guinea pig work.

DR. BINING: Before we respond.

DR. LOSCUTOFF: Yes, go ahead.

Avtar wants to say something.

DR. BINING: I want to say something, then we can move on. I was wondering that if we can spend a few minutes on the criteria list.

DR. LOSCUTOFF: Oh, you want to do that?

DR. BINING: There are some other points that we need to add. Let's quickly do that.

DR. LOSCUTOFF: All right. Let's do that.

MR. SPATARU: You have 11 wonderful criteria that you've identified, what I think is a very, very good exercise, so I commend you for having done that.

And when you look at those again you got to come back and ask yourselves: What is it that we're trying to achieve for the little money that we've got? Are we looking for impact? Are we looking for short-term impact, or are we looking for long-term impact, or are we looking for a breakdown between the two? And how are we willing to allocate that?

And I submit to you that -- which somebody's got to start someplace.

DR. LOSCUTOFF: Yes.

MR. SPATARU: And I submit to you that given it is a small amount of money, and given that there has only been a few projects completed to date, that you're looking for a short-term bang, you're looking for a short-term impact, something that's not only going to be a success in terms of technology, but preferably it's going to be a commercial success, so you can justify additional funding and continuity of the program, which I think is definitely one of the goals. Maybe it hasn't been spoken, but I believe that to be one of the goals. Okay?

And as such I think one of the attributes, one of the criteria we want to look at is efficiency improvements. I believe that to be one of the primary issues. And emission reductions and things that have to do with commercialization of the product, like overall cost and synergy with industry. Where did you have that? You had something in there with industry.

DR. BINING: Five.

MR. SPATARU: Five, okay. I think those should be the dominant factors in going through this exercise, because I believe the focus should be for let's get some bang for the buck, for the little buck that we've got.

DR. LOSCUTOFF: Okay. So criteria then. Efficiency, emissions and then

--

DR. BINING: Commercialization.

DR. LOSCUTOFF: -- commercialization potential?

MR. SPATARU: Yes, synergism commercialization.

DR. LOSCUTOFF: Okay.

MR. SPATARU: And somebody could take the product to market.

DR. LOSCUTOFF: Right. All right.

MR. SPATARU: Somebody's got to make a dollar.

MR. RAMBACH: So then commercialization potential, that's economic opportunity and benefit rights.

DR. LOSCUTOFF: Right.

MR. SPATARU: Right. And in the short term.

DR. LOSCUTOFF: Right.

DR. BINING: These are all near term.

MR. SPATARU: I would say near term because you've got to justify the money being spend.

DR. LOSCUTOFF: With the limited funding being spent we've got to go for the near-term potential. Okay, near term.

MR. SPATARU: Remember this program was originally set up as some kind of an investment bank to advance technology and to create jobs in California.

DR. LOSCUTOFF: Well, that would be one of the attributes of it, one of

these criteria, near-term potential. Okay, you did all of them. Okay.

MR. RAMBACH: Bill Gates paid off his investors in two years, but it wasn't too much later that there was a huge economic benefit to, you know, wherever he lives. So you know, I think that term stretches all over the place. The payback is in near term, payback to TETAP. But the economic benefit, creating jobs for the long run and things like that, you go --

MR. SPATARU: In short, I look at those as being externalities at this point, from an economic point of view. I see those as a longer term of the desirable benefit, but I see there's a longer-term benefit. I think we need to focus on what can we get done, let's say, within three years. Then I think that's the criteria. What can we get done, get results, for the three years? If we don't put that kind of a limit on it, I think we're hurting ourselves.

DR. LOSCUTOFF: You may want to say three to five years, some kind of a span, three to seven years, near term, yes.

Okay. Anything else besides efficiency, emissions, commercialization potential. Okay, anything else?

I think those were the three main ones. With that in mind, all right, good. Thank you Alex. I think we needed a criteria -- set a criteria, to be able to decide.

Okay, anything else?

Now commercialization potential has a number of elements in it. One, it

talks about technology readiness and also talks about cost, right? So it has a number of criteria within it. It's not a simple one.

MR. EASTWOOD: Yes, because -- a question?

DR. LOSCUTOFF: Yes.

MR. EASTWOOD: My name is John Eastwood. I'm interested in flywheels.

I have to clearly state my interest so that I can't be accused of conflicts of interest. I mean I'm assuming that the kind of program we're talking about here is a program which, let's say, it defines those objectives, but it -- sorry -- it incorporates those objectives, but those are the objectives that essentially were discussed this morning, because basically they reflect the objectives of the CEC.

So therefore any project, any program that's pursued should presumably incorporate those. So therefore if you're talking about -- for example, I mean talking about a specific project. In my case I'd say, okay, I want to develop a flywheel for application in a commercial vehicle, shall we say.

In which case obviously there's benefits of efficiency because you're looking at a hybrid drive train that comes along with reduction of emissions. And ultimately, of course, you want to commercialize by producing lots of them and having lots of hybrid vehicles.

Is that the kind of thing you're looking at here, Walt?

DR. LOSCUTOFF: Yes, precisely.

MR. EASTWOOD: Okay. All right.

DR. LOSCUTOFF: See, John paid me in advance, spotted me at lunch. So that's why --

MR. EASTWOOD: Did I do that?

DR. LOSCUTOFF: That's right.

MR. EASTWOOD: Or do you want to be more specific than that? Is that the sort of generalized idea you got, Walt?

DR. LOSCUTOFF: Do you want to focus on mid-term criteria now -- mid-term criteria?

MR. SPATARU: Alex Spataru.

I totally agree, but we've got to put a time limit on that it's got to be a technology that you got to be able to take to market within "X" years.

DR. LOSCUTOFF: Okay. Now lest we forget we got something up there.

MR. SWEET: So would he tell us exactly what his suggestion is? What type of technology is he talking -- the first one he did. Is that a flywheel or what?

DR. BINING: This one?

MR. SWEET: Yes.

DR. BINING: This one's a flywheel.

DR. LOSCUTOFF: An example of a flywheel.

DR. BINING: Just an example.

MR. SWEET: Okay.

DR. BINING: Yes, we have no -- the start of that discussion.

DR. LOSCUTOFF: Okay. Technology, the one that Avtar had mentioned.

In fact, we could probably put the four of them up here. It's a start.

We'll, John decided to go volunteer as a guinea pig, whereas I --

MR. EASTWOOD: That's fine, that's great. Because you said one other thing there. If I may add, I want you to say -- he knows you've got three criteria, but I think that important in that is the criteria of time. You know, I mean because if it's 10 years down the road because he's some --

DR. LOSCUTOFF: No, he said it's near term.

DR. BINING: Near term.

MR. EASTWOOD: Oh, near term in this case is what, three years?

DR. LOSCUTOFF: Yes, within five, seven years -- three to seven years, something like that.

MR. SPATARU: Is it five, is it three, or is it seven? Does the ROI change us on that one? So you got to pick. I think you've got to pick a time.

DR. BINING: Under five years.

MR. SPATARU: Under five years?

DR. LOSCUTOFF: Under five, okay.

All right. Do you want to pick a general term or a more specific one, let's say hybrid. There's some of the first one on that list.

MR. EASTWOOD: You say hybrid fuel criteria? Here it's hybrid --

DR. LOSCUTOFF: Yes, hybrid vehicle technology.

MR. SPATARU: It's any hybrid.

DR. LOSCUTOFF: Any hybrid, yes.

MR. EASTWOOD: You called it ICE electric hybrid, right?

DR. LOSCUTOFF: Well, that was one specific one. Let's get one.

MR. EASTWOOD: I can talk louder than the loudspeaker.

DR. LOSCUTOFF: Positive attributes for hybrid vehicle.

MR. SPATARU: Range.

DR. LOSCUTOFF: Okay.

MR. SPATARU: All kinds of attributes.

DR. LOSCUTOFF: All kinds of attributes.

MR. SPATARU: They all have lots of attributes.

DR. BINING: What's the preferred one?

MR. SPATARU: Okay. Hybrid, you get real efficiencies because you end up getting better mileage. And it's a -- plus you are using the type of energy commodity that you're using. You're using a mix of commodities so that's desirable rather than one.

DR. LOSCUTOFF: Okay. So you're using a number of -- like flexibility.

MR. SPATARU: Right, flexibility. So that's a value.

DR. LOSCUTOFF: Mix of energy, okay.

MR. SPATARU: An advancement of technology. You're pushing the envelope. That's a positive.

DR. LOSCUTOFF: That would be negative because now you're coming up against a barrier. Part of technology doesn't --

MR. SPATARU: All right, I'll take that back.

MR. EASTWOOD: Environmentally beneficial.

MR. SPATARU: Environmentally beneficial.

MR. EASTWOOD: Because it improves the efficiency. It's a byproduct of the efficiency.

DR. LOSCUTOFF: Okay.

MR. EASTWOOD: Reduction of emissions, reduction of black smoke, more environmentally friendly in a real sense, i.e., in a community because you don't have black smoke everywhere.

DR. LOSCUTOFF: Okay, emissions.

Anything else?

MR. RAMBACH: It's a worldwide commercialization opportunity.

DR. LOSCUTOFF: Okay. You have a very large commercialization

opportunity.

MR. RAMBACH: It's exports.

DR. LOSCUTOFF: Yes. It's exports, yes, very large.

MR. RAMBACH: Large or very large, I don't know the difference.

DR. LOSCUTOFF: Large, very large, whatever. You're right. I don't like adjectives either.

Okay, yes.

MR. ASHUCKIAN: David Ashuckian, CARB.

High production capability.

DR. LOSCUTOFF: Production capability. What do you mean?

MR. ASHUCKIAN: Flywheels have the potential for mass production.

DR. LOSCUTOFF: Okay. We're talking about hybrid in general, right?

MR. ASHUCKIAN: Oh, in general, okay.

DR. LOSCUTOFF: Yes, but still you're correct, though.

MR. SPATARU: You're talking about an off-the-shelf product, or what?

The availability of being up --

MR. ASHUCKIAN: I was thinking of flywheels in hybrids as opposed to --
I thought we were using flywheels as the guinea pig here. But I guess we're done with that.

DR. LOSCUTOFF: Just in general, a lot of these hybrids, the reason they're

good is because we do have, in essence, off-the-shelf items. I mean, for example, the hybrids that Toyota has, or even that we build at Fresno State, electric motor, internal combustion motor, put them together. We had a hybrid that got 55 miles per gallon. We ran it up and down the state. I mean it can be done. We've done it.

MR. SPATARU: The off-the-shelf capability.

DR. LOSCUTOFF: Yes. That I like.

MR. SPATARU: That I'll support.

DR. LOSCUTOFF: That's positive. Okay, yes, sir.

MR. SPIEWAK: I'm not so sure that all hybrids are off-the-shelf capability.

DR. LOSCUTOFF: No, not all, but you're right. The other side of it, too, is you have potential for development. You're right. But there is that potential for them right now. There's that availability at this time, yes.

MR. ADDY: Can I make a comment, without having to dampen your free flow of information amongst the group? We're trying to accommodate the recorder there by asking you to use the mics. So I'll ask you again to please raise your hand and let us give you a microphone before you make your remark. Is that okay?

DR. LOSCUTOFF: Okay. I won't let them talk until they get the mic. So you better run fast. Have you got your skates on?

MR. ADDY: We'll do the roving microphone.

DR. LOSCUTOFF: And identification.

DR. HALBERSTADT: Marcel Halberstadt. I'm sorry. I have a process question. Can you explain to me what we're doing at the moment?

DR. LOSCUTOFF: What we're trying to do is identify certain technologies here. And there are several. And positive or negative, yes, are their attributes, their characteristics. Once we're done with them, let's say, four, five or six, if we identify that many that are good, then that, in essence, will be your input to us. This is worthwhile pursuing.

What I'd like to do is, after we get them on the board here, and in the process of putting them on the board, have discussions about their viability. Are they any good and why they're good? Okay, why there's some benefits from them. Like, for example, in the first case, the attributes, efficiency, emissions. Look at commercialization potential, look at the barriers.

And once this list is done, decide is this the one we want to pursue or not. Is this one that the CEC should fund?

Okay? It's just an identification process that we ask you to help us to go through.

MR. VLASEK: Greg Vlasek. I share the concern; I'm a little afraid we're getting something lost here. You have, I think, four categories that you're

talking about all of which are onboard vehicle technology development. And it seems like we've already foreclosed any further discussion of infrastructure, and maybe some other things, too. So I just want to be clear on the outcome of this process.

DR. LOSCUTOFF: On these four categories we put up there they're not a choice of categories. I guess what I said earlier is that I put them up there only because, after I had mentioned them, it's a wide open area. Before I put them up there, those were just examples. No, we do not want to preclude any other technologies.

MR. ASHUCKIAN: Dave Ashuckian, CARB.

I was under the impression that these four categories, at least, fuel cells, low emission hybrid, et cetera, are kind of already a given as desirable technologies to pursue, in that we would look at a specific process within this technology that can be pursued in the program.

DR. LOSCUTOFF: No. We're a step backward from it.

MR. ASHUCKIAN: Okay.

DR. LOSCUTOFF: We at CEC identify these as being important. But what I would like to do is get inputs from you to see what your feeling about them is. Perhaps there might be others that are better than these over here.

And, like Greg mentioned here, we may want to look at infrastructure

itself which may be beyond what we have here, which may not be mentioned here.

And then in the process, once we identify, we get another list that may be different from what we have over here. And in the process, hopefully we'll get the inputs from you and then use that process to then refine our own thinking here. Okay? So I'll shut this off so that this doesn't affect you.

MR. SWEET: Arthur Sweet from Goremobile Industries.

CalTrans is currently testing a system that we put in on their tow trucks on the Bay Bridge and some shadow barrier trucks. It's diesel, existing diesel equipment modified with an add-on natural gas-metered injection system, power oriented, that takes and reduces the amount of diesel used and increases the amount of naturally-produced natural gas from the United States, as opposed to oil imports.

It has two aspects to it. Number one, one of the companies that's also testing this system -- actually it's a waste refuse hauler -- they have a dump that they own and operate. And they're producing they're own methane gas. So this would be a composite system where they would save the methane gas, compress it and use it for their pickup trucks, their trash refuse trucks. So it's kind of a combination system.

It also has the major advantage of being something that's an interim

system between the time that they develop the magic electric, nonpolluting whatever it is, and the existing equipment. The diesels never wear out; they just go on forever. So we're solving a problem that will continue a long time.

So I'd like to have that considered as a potential.

DR. LOSCUTOFF: As a?

MR. SWEET: Hybrid.

DR. LOSCUTOFF: A hybrid then? Another type of hybrid, yes. Okay.

DR. BINING: Avtar Bining from CEC. Here we have, considering this first technology, as hybrid electric vehicles. And, as we move along, we fill this sheet, we can move on to the other technology categories.

MR. SPATARU: That's a hybrid electric. Not a hybrid accumulator, a hybrid electric.

DR. LOSCUTOFF: You don't need the hybrid, though. Just hybrids combined. Just a hybrid right now and again break it up later on.

MR. SPATARU: I'll just hybrid everything.

DR. BINING: Probably that may become too complex for us. Let's focus on hybrid EVs buses.

DR. LOSCUTOFF: Do you want to do that first? Okay.

MR. GUERIN: J. T. Guerin from AeroVironment. I think this seems somewhat of a remedial task. Forgive me if I'm out of place. But I think

everyone here thinks hybrid EVs are a good thing to pursue. You've made that list, come up with all these ideas. And I don't think anyone's in any disagreement that hybrid EVs are a good thing, that we should maybe write things on. I think maybe we do this quickly and just -- anyone goes to the list -- if anyone objects to any certain ones, well, this one shouldn't be on the list, or throw up ideas of things we should add to the list of the ones that we maybe should debate.

I think debating whether hybrid EVs are good or bad, or EVs are good or bad, I think that's why we're all here is because we all want to see these things happen. I think going up there and writing hybrids are more efficient, have less emissions, we all know and understand that. I think we're kind of taking a step backwards.

DR. LOSCUTOFF: Okay. One more comment?

DR. RAY SMITH: Ray Smith, Lawrence Livermore.

I think unfortunately hybrid EV is a very ambiguous term. You really have to say what you mean. I think some of us -- my experience has been when you talk to people about what's a hybrid, everybody has their own definition, their own conception, their own configuration.

This could go the full extreme to the totally independent hybrid. That's a hybrid electric, meaning electric tractive drive and does regenerative braking.

That's one kind of totally independent. You only put fuel in it, kind of hybrid, to the promotion by Professor Andy Frank at UC Davis of the grid depletion hybrid where you charge it up at home like an electric vehicle. And, oh, by the way, you can also put fuel in it if you need a longer range.

DR. LOSCUTOFF: Right, and charge up, yes.

DR. RAY SMITH: You know, so this is a huge range of things. But I do agree that everyone knows that these vehicles will be far more efficient and could make major shifts in the fuel infrastructure.

DR. LOSCUTOFF: Yes. Well, actually both of you have made the point of -- let's say that, A, this is a good thing. This is one area we want to get into. Let's go down the list in terms of the attributes, put a lot of positive ones here, commercialization potential. Sounds like considering the range of possibilities.

High barriers. Okay, that's a thing that we didn't consider. The problem is we need to do the last step. How should we focus on that? What must CEC do, or what can CEC do? Perhaps that's what we want to do here.

DR. RAY SMITH: Smith, Lawrence Livermore, again.

The chief barrier to hybrids is energy storage. All the other components are almost off the shelf. Energy storage is the big problem for hybrids.

MR. SPATARU: Alex Spataru with A-DEPT Group.

I would partially agree with you. I would say energy storage is half the

problem. I'd say regenerative braking, retainment, energy conversation is the other half of the equation. It seems that the process by which you store the energy is equally important as a method of storing the energy.

DR. LOSCUTOFF: Okay.

MR. GUERIN: J. T. Guerin, AeroVironment.

If we're going to keep throwing energy storage and this is one-half -- I think -- and probably the most important -- at least in my understanding from major automakers -- is marketability. We may be able to solve the battery problem, the energy storage problem, the regenerative braking problem. But if we can't make it cost effective, it doesn't matter.

DR. LOSCUTOFF: Yes.

MR. GUERIN: I think on every single thing we're looking at here cost is the bottom line. You talked about cost on fuel cell systems, but there isn't a line about cost on battery systems. You want higher specific energy, higher specific power, but there's nothing about cost and life issues, which I think are probably, bottom line, the most important issue across the board.

DR. LOSCUTOFF: Okay.

MR. FONG: Dan Fong with the Commission.

I have a question on your comment about cost. We understand that, yes, consumers, when they're faced with high, either initial purchase cost or

operating cost, will tend not to then make that decision.

I guess my question is: From a TETAP perspective, if we have some money to invest, in trying to make the hybrid electric vehicle more attractive to the consumer, what sort of attributes of that hybrid electric should we try to improve with our money? Is it energy storage? Is there something that we can do, from our standpoint, through our TETAP Program, that would make energy storage less costly, or is it regenerative braking? Can we invest some money that makes regenerative braking more effective?

Yes, we understand that cost effectiveness is the major issue. But what are the key technical issues that TETAP can overcome, or at least help some of you people overcome?

MR. SCHWARTZ: Fred Schwartz, Trinity Flywheel.

You're dealing with a complex system. If you pull one component of it out and work solely on that, you're going to have major problems, especially when you're dealing with a very complex integrated system. What you're after is the integrated system to work.

And so there are no either/or questions that can, you know, be posed that are going to be really helpful. It's not going to be either this or that. If you've got a particular convergence of technology and management and potential advances, then you know, you pick the winners out of those that you can. And what must

be done? You've got to throw money at it.

DR. LOSCUTOFF: Yes, but at what, though? I mean we're talking about specifics. Yes, throw money at what? What do we throw money at?

MR. SCHWARTZ: Well, I'm not going to divulge what I think the best project would be right now. But you are going after good-looking projects with proponents that you are familiar with, that you feel comfortable with. You know, just picking out one element of technology, to go after, I just don't think is going to work. You're after a whole constellation of things that create a successful development and advancement in, you know, a hybrid vehicle, which is a very complex vehicle.

MR. SPATARU: Alex Spataru. What you're looking at here is -- my perception of what we're looking here is an investment strategy, and what are we going to invest our money in? And we're talking -- to do that investment strategy you're going to have to have some cutoffs. And one of those cutoffs is can this thing turn profitable in five years? And if it doesn't, then you don't consider it.

We're going through this process to come up with examples of what might be considered as the kind of a project, that kind of an investment opportunity that's going to pay off in five years. And it's going to be more efficient in terms of fuel. It's going to clean up the air. It's going to improve the world, da, da, da,

da. You know, how are you going to put that on the record? I don't know. But that's the idea. Anyway, that's it.

DR. BINING: Avtar Bining. I think we agree on one thing, but we need to focus on technical barriers. If you can tell us that, okay. Within this hybrid electric vehicle technology category, this is the critical problem that we need to focus on.

Like some people mentioned about energy storage, it could be in a different form. It could be in the form of batteries. It could be the best form of flywheel. So that is what we are looking for, that if we want to put our money into that particular critical complement battery.

MR. SPATARU: Alex Spataru, again. But that is a burden of the entity submitting the proposal to you. They have to substantiate that what they're proposing to you for funding makes sense. May that be -- whatever it is. But the burden is not on you. It's on the proponent of that particular technology, or subset of a technology, to make their case to you. And you shouldn't be taking that burden on.

DR. LOSCUTOFF: But we have to have the fundamental understanding, the knowledge and the guidance in order to be able to make that decision.

MR. SPATARU: Well, you got it right there.

DR. LOSCUTOFF: Okay. That you're providing us?

MR. SPATARU: Yes.

DR. LOSCUTOFF: Now, by the way, when you talk about hybrid EVs, even a powered flywheel has electric motors in it. Okay? We're not talking about it. So one is a electro-mechanical battery, one is an electro-chemical battery. So I think that kind of covers everything.

I've got to appease this guy.

MR. EASTWOOD: I'm going to do it right this time. This is John Eastwood with Trinity.

You know, I think that Ray Smith was absolutely correct. I mean he basically identified what constitutes the major barrier to the effective implementation of hybrids. And that is the question of energy storage. And then that was supplemented by the question of regenerative reliability. And, absolutely, they go hand-in-hand.

And therefore any development program or any program that is embraced by the CEC should, in my opinion, in some way -- and it relates to hybrid EV, shall we say -- then obviously it's got to emphasize the enhancement of the existing state of those technologies so that it becomes more of a practical possibility. And that includes cost -- considerations of cost. But its energy storage and regenerative reliability is -- well, it's the same thing really -- braking, yes.

So I agree. I think that's absolutely appropriate. But it doesn't make any difference whether it's a flywheel that stores it or a battery that stores it; you have to have energy storage in a hybrid vehicle, period.

DR. LOSCUTOFF: Okay. Go ahead.

MR. COLE: Jim Cole, with Southwest Research.

The conversation is kind of going around. I wanted to talk about a technical barrier to hybrids. And the reason a hybrid vehicle is more efficient and lower emission is because theoretically you could optimize an engine in there for low emissions and high thermal efficiency.

Most of the demonstrations that we are aware of don't necessarily have engines that are optimized to do this. And there's a significant amount of engine development that could be put towards actually optimizing the engine for the high efficiency and the super low emissions.

Right now a lot of people will spend a lot of money on all of the more challenging technologies of regenerative braking, and battery storage, and things like that.

And they always forget about the engine. And the last minute they look around and say I need a hundred horse power engine, who's got one? They bolt it in there, stick it in there. And they end up with not demonstrating really good emissions numbers, not demonstrating as good fuel economy, so it doesn't get

the hybrid business rolling maybe as good as it could be.

DR. LOSCUTOFF: Hear that, John?

MR. KITOWSKI: This is Jack Kitowski, with the Air Resources Board.

Considering that Toyota has a hybrid that they are marketing next year, at least thousands of units are going to be sold supposedly, what does CEC look at when they're looking for a hybrid proposer, or are you totally opening that up to us? Considering there is a benchmark out there now, are you looking for improvements from that? Are you looking for a totally different designs that you could have advantages from emissions standpoint that the Toyota doesn't have?

DR. LOSCUTOFF: Yes to both questions, actually.

MR. KITOWSKI: Do you compare it against a benchmark like the Toyota, or other hybrids that are out there, or do you start with a blank sheet of paper?

DR. LOSCUTOFF: Well, it depends on what you compare to. For example, we're looking beyond just automobiles, trucks, off-roads, trains, whatever there is out there. And it could even be stationary. I don't know how far it can go there. I think it should be wide open in terms of hybrids. What's your comment?

DR. BINING: Avtar Bining. Jack's comment is very right. So this is technology advancement. If we are doing something that is already being done,

then we are not doing anything on technology advancement. If a benchmark is due then, let's move from that point onward. And what is the technical barrier from that point onward; that is what I am looking for.

DR. LOSCUTOFF: Why is this better?

Alex.

MR. SPATARU: Alex Spataru. So the question should be: Why is this better than existing technology? That should be one of the criteria that goes on to whether a technology should be financed, supported, or not. Why is it what you are proposing better than existing technology? That should be one of the criteria. Is that not the end result of that conversation?

DR. BINING: Jack's comment was that Toyota already has a hybrid electric vehicle --

MR. SPATARU: Right.

DR. BINING: -- that is commercially available, or it is going to be commercially available. What CEC can do, or what CEC wants to do, is it what Toyota has already done, and we are trying to do one step behind that, or do we want to move beyond that point where Toyota is already there.

MR. SPATARU: And I submit to you since --

DR. BINING: And my comment to that was we want to move further than that.

MR. SPATARU: Total agreement, total agreement.

DR. BINING: And if you guys feel that this is the critical element, which can take you beyond what Toyota has already achieved, that is what we are looking for.

MR. SPATARU: Yes. And, number two, I want to support Jim's comment, which was made earlier, regarding the commonality of the technology. If you have one technology that addresses a number of issues, like the engine, if you make, improve an internal combustion engine for a hybrid, or improve it in terms of some other application, for classical applications, then that should receive a higher priority in terms of consideration for funding than one that only addresses one particular industry.

If you come up with a -- let me submit an example -- if you come with a sensor that is applicable to a number of industries, then it would work as well with alternative fuels; it would work as well with classical fuels, and it would give you better emission, better efficiency and better emissions than that because it has a broad commonality. The key word being "commonality." Then that should receive priority consideration that's something that addresses only a very narrow area of improvement.

DR. LOSCUTOFF: Thank you.

DR. RAY SMITH: Ray Smith, Lawrence Livermore.

I know what you're trying to do. I want you to be able to do it. Three million dollars is not on the right side of what you need to do. I think you have to look at those really high leverage things and be very focused on those. There's a whole host of things we'd all like to do.

The implementation of these things is going to take big manufacturers. The small manufacturers and the small businesses may generate the ideas that the big guys buy. But, you know, we really need to focus on those things that really make a difference.

For instance, and I would submit that CEC seriously consider establishing standards. And for hybrid EVs that are range-extended hybrids, or range-extended EVs, if you will, meaning a charge depletion kind of hybrid, mostly a battery electric car with some kind of a small APU on it.

That kind of thing that had standard charging, just like the rest of the EVs that are going to be rolling off, eventually, could allow you to do what you want to do, which is shift away from the petroleum-base fuels, because it would put more on the utilities and an off-load conditions so that, you know, it better balances utilities, anyway. I think that's the kind of thing, if you promote the idea of the grid depletion hybrid, that would really serve your purpose, and they're standards that required to do that.

DR. LOSCUTOFF: Okay. So EV, that's just a short phrase. Establish

standards then for the hybrids, is what you're saying, right?

DR. RAY SMITH: Yes. To get those kind of hybrids that you want that will shift you away from the petroleum.

DR. LOSCUTOFF: Yes, okay.

DR. BINING: Ray, if I understand your comment correctly, can I put it in this last category of what needs to be done?

DR. LOSCUTOFF: Yes, what must be done.

DR. BINING: Establish standards.

DR. LOSCUTOFF: Yes. For hybrids operation, yes. Okay, with the limited funding that we have. That's probably the best we can hope for, rather than trying to develop a whole new storage technology, or battery, or whatever is required.

MR. KRAGEN: Mark Kragen, Calstart.

I guess I threw up a red flag. I'm concerned when someone said, "Okay, Toyota's got a hybrid, let's use that as the benchmark," and then we need to improve the technology beyond that. Well, there's also the cost factor. So there's a guy here from Toyota I see from the business cards.

I doubt Toyota's making any money on those hybrids right now because of the cost of the system. If there are improvements in cost that can be had, I think that should be a factor in considering the evaluation as well. Even though it

might not be improving above the benchmark performance technology, if there are improvements in cost that can be realized, that that should be considered as well.

MR. FONG: Just in finishing up the concept of this Toyota's hybrid. It was focused on energy reduction, or high fuel economy, whereas as far as the Air Resources Board is concerned it didn't address reduced emissions as much as we would have liked. And so we would like to see focus on reduced emission development in hybrids, which is really not a focus of the automakers at this point.

DR. LOSCUTOFF: Okay.

DR. BINING: That means the technical barrier is to work on emissions?

DR. LOSCUTOFF: Emissions, yes, reduced emissions. Ray?

DR. RAY SMITH: Can I ask a question of the gentleman, then? Does that mean that CARB will entertain an equivalent ZEV rule for hybrids?

MR. ASHUCKIAN: We're going to have a workshop in two weeks on the new LEV II Program. And we are looking at potentially granting partial credit for extremely low emission vehicles.

DR. RAY SMITH: If it's one-tenth of ULEV and therefore ZEV equivalent, why shouldn't it get full credit?

MR. ASHUCKIAN: No comment on ZEV equivalents at this point. We

want to promote extremely clean vehicles.

DR. RAY SMITH: And the CEC's charter is to reduce the fuel consumed in this state.

MR. ASHUCKIAN: Correct.

DR. RAY SMITH: And if you hold that up, by holding out for ZEVs, that could be a problem.

MR. ASHUCKIAN: No. What I'm saying here, as we've heard earlier, by collaborating our programs and focusing on advancing the energy efficiency of these vehicles, as well as emission reduction, we can achieve both.

DR. LOSCUTOFF: Okay. Thank you, Dave.

Okay, let's wrap this thing up, otherwise we're going to run out of time very quickly. Any last comments, one more.

MR. EASTWOOD: Yes.

DR. LOSCUTOFF: Okay. Since you wanted to be the first guinea pig, let's wrap it up.

MR. EASTWOOD: I don't know whether I ended up being an effective guinea pig. This is John Eastwood, with Trinity. I would propose that the demonstration hybrid be an appropriate priority for the CEC. And obviously, since I have my own interest at heart, I would suggest that that incorporate flywheels for the storage technology.

DR. LOSCUTOFF: Okay. One of excellent suggestions. Just a separate demo, I guess, would be on this.

MR. EASTWOOD: Yes. Demo, what must be done. Demo.

DR. LOSCUTOFF: Okay. What do we focus on, those? Oh, you've said flywheels in your case, yes, flywheels.

DR. RAY SMITH: Plus storage.

DR. LOSCUTOFF: Storage, that was storage, okay.

DR. RAY SMITH: Yes.

DR. LOSCUTOFF: Can we deal effectively within the costs?

DR. RAY SMITH: Well, because we concentrate.

DR. BINING: Anything else on this?

DR. LOSCUTOFF: All right. I guess the feeling that I get that, yes, hybrids are good, something we want to work on, right, something CEC should get involved in; is that a feeling? Yes, yes.

MR. SPATARU: Hybrids are good.

DR. LOSCUTOFF: Okay. We know that. But is it something CEC should be working on? That's the question. You see, that's the whole thing.

MR. SCHWARTZ: Some say a hybrid demo program.

DR. LOSCUTOFF: How about a hybrid demo program? Yes, that would be okay.

DR. HALBERSTADT: Is it the question should you be soliciting proposals?

DR. LOSCUTOFF: Yes. Should we be soliciting. Yes, that's the question. Should we be soliciting proposals in this area?

All right, next one. Forget about Avtar's list. From the floor.

MR. SWEET: I'd still want to have a consideration of something that provides an interim strategy between now and the year 2008 involving existing diesels, modified to be more efficient, utilize clean-burning natural gas and create their own fuel out of waste facilities that methane gas is currently being burned.

DR. LOSCUTOFF: Okay, can we back up. Except for the last one, let's cut off before your last statement. Heavy-duty, low emission engines, right? Internal combustion engines.

MR. SWEET: Yes.

DR. LOSCUTOFF: Not diesel. Heavy-duty, low emission, internal combustion engines. Okay, that's the next technology. That happens to be one of yours, Avtar.

MR. SPATARU: Alex Spataru, with A-DEPT.

Does this include lean-burning technologies. That's -- does that stress lean burning, or is that a subset of that? Is that a subset of that particular heading or not?

DR. LOSCUTOFF: Does it exclude it?

MR. SPATARU: No.

DR. LOSCUTOFF: Okay.

MR. SPATARU: Is lean-burn technologies a subset of that? That's the point that I'm trying to make.

DR. LOSCUTOFF: Is it low emission?

MR. SPATARU: Yes.

DR. LOSCUTOFF: Is it heavy-duty? Is it high efficiency?

MR. SPATARU: Yes.

DR. LOSCUTOFF: Yes. Okay.

MR. SPATARU: Okay, thank you.

MR. NORTON: Paul Norton, with NREL.

I think in the past we've been willing to take some efficiency hits in heavy-duty natural gas engines in order to get some products on the market. And there are products on the market now. They're not selling quite up to expectations of the engine companies.

And I think for a technology advancement program we should be looking at moving natural gas heavy-duty engines towards diesel-like efficiencies, rather than looking for expanded market products. So I think that that's something that should be very high on the list when we're looking at heavy-duty

alternative fuel engines. Right now it's trying to match the diesel-like efficiency.

DR. LOSCUTOFF: But you said with the high efficiency alternate fuels; is that what you're saying, Paul?

MR. NORTON: Yes. I'm saying high efficiency should be a key.

DR. LOSCUTOFF: A key, yes.

MR. NORTON: In other words, not just developing engines that work on alternative fuels, but --

DR. LOSCUTOFF: High efficiency.

MR. NORTON: -- hold them to the same standards we would a diesel in terms of efficiency.

DR. LOSCUTOFF: Okay. So low emission, high efficiency. So we're consistent here with the statement, then. Okay. And again I think the attributes are almost as great. Here are the attributes, high efficiency and low emissions sort of come next.

Commercialization potential, I think high. I'm not so sure it's in the question. Okay?

What are the barriers to it? Greg, I guess you should go ahead.

MR. VLASEK: Greg Vlasek. And I didn't have a comment on barriers. I'm sorry for missing the point there.

But I'm wondering, we were talking specifically heavy-duty, but wouldn't

it be equally important to try and address all high fuel consumption-type applications, which might include some medium-duty, is my suggestion. Is that precluded by the tone of the -- or by the direction here? I'd say it ought to be.

DR. LOSCUTOFF: It should be. We'll go ahead. I'm taking it longer.

DR. BINING: I have a comment, though. Avtar Bining. Just some of those technologies probably they're transferable from a medium-duty to heavy-duty, or vice versa. That is one way of doing it, that we just ignore that aspect. We simply say low emission, high efficiency generally in high-volume applications, or if we want to separate them we can do separate work. What is the consensus here?

MR. VLASEK: It just seems to me that we went through a lot of this stuff back in June. And it's very well detailed in the six pages of project categories that you have here. So I guess I'm a little -- I just don't want this process to somehow foreclose that, all of the very important and worthwhile types of projects that are already detailed out here in your packet. And I guess my only concern with this process is that might be heading in that direction. I think you've got it laid out here pretty well.

DR. BINING: The purpose of doing it again is that those people who were not participating in that discussion, if they can contribute more this time. So that is the intent. It was not to negate what we did before, but to get more input.

DR. LOSCUTOFF: Supplement. Yes, back there.

MR. NORTON: This is Paul Norton, from NREL.

I just want to agree with Avtar that a lot of the heavy-duty technology is transferable to the medium-duty engines. And, in fact, Caterpillar and Cummins are very much focusing on their medium-duty engines in alternative fuels right now.

Is anyone from Cat or Cummins here?

But I think in terms of barriers, I think one of the barriers for high efficiency alternative fuel engines is that the focus has been on spark-ignited, lean-burn throttle technology. And we need to look at how either to move beyond that into something like a micro pilot or a direct injection compression ignition engine, or to move spark-ignited, lean-burn technology up into efficiencies similar to diesels by maybe some stratified charge or minimizing throttle use.

So in terms of barriers I think the barrier towards a high efficiency alternative fuel engine, and I guess natural gases and propane, to some extent, are what we have on the market today, is the fact that they are lean-burn, spark-ignited, throttled engines. And that, if we consider a program for technology advancement, that we should somehow move beyond that technology either by dramatically improving that technology or by moving away

from that.

DR. LOSCUTOFF: Yes. The barrier. Lean-burn spark. Okay.

MR. ANDREONI: I see another barrier for heavy-duty vehicles in general, is that there is generally lower fleet turnover and thus lower production numbers made. And so it's harder to get new technologies implemented as rapidly as in the light-duty fleet. I'm not sure that can be overcome or not.

MR. WIENS: Jerry Wiens with the Energy Commission. I just wanted to add that another way to reduce the problem with the lower efficiency throttled natural gas engines, perhaps, would be to put them in a hybrid vehicle where the driving cycle would lend itself, where you could run the engine at its most efficient point. It would be another way to go out that issue.

DR. LOSCUTOFF: And not to worry about this, yes. Okay. It goes back to the hybrids. So here we go.

Okay. Another barrier.

MR. FONG: Any other --

DR. LOSCUTOFF: The barrier, advancement. Okay.

Other barriers?

DR. RAY SMITH: Smith, Lawrence Livermore again. One of the things that you find, I think, if you look into the real way that heavy-duty vehicles are used a great deal, there are systems out there, small systems now that are

commercially available that are like pony engines that people are using to shut down their big rigs and run these small systems. Those right now are not very attractive because of their cost and the packaging and things of that nature.

This is the kind of size project that the CEC could really jump on and develop as a package that could make an enormous difference into the actual diesel fuel used.

DR. LOSCUTOFF: Yes. So what is needed. Let's put Paul's in and yours. And one is like an APU panel. It's like an auxiliary power unit, and you have to start it. And Paul was saying in terms of moving to a different concept on diesels, go to like what Gerry suggested, hybrids. So those are what needs to be done. Those are three items. Do you want to get them on?

So, Paul, your suggestion is go to a new concept. Do you have anything in mind in particular of what needs to be done?

MR. NORTON: Well, what I'm saying is not to do more of the same, I guess is what I'm saying.

DR. LOSCUTOFF: Yes.

MR. NORTON: Is that we should demand an increased efficiency, because the heavy-duty engines, alternative fuel engines that are entering the market now, the efficiency reduction, Jerry Wiens from CEC has done a lot of work on this, is very substantial. And that's going to be a major barrier in terms of

market penetration. And I think that if we're going to develop more heavy-duty alternative fuel engines, we need to demand a high-enough efficiency that they won't face that same market barrier.

DR. LOSCUTOFF: But you're not telling us how, though? That's what I was asking, the specific point.

MR. NORTON: No. No, I don't want to say exactly how. I think the engine manufacturers are better at saying how to meet a certain goal. I think it's --

DR. LOSCUTOFF: Solicit then that. Okay.

MR. NORTON: It's our job to set the goal.

DR. LOSCUTOFF: Yes.

MR. NORTON: It's their job to say how they're going to do it, personally.

DR. LOSCUTOFF: Okay. Let's say you have this new concept for improved efficiency and then hybrid, and I guess I'll call it APU for lack of a better thing. New concepts for higher efficiency. And then hybrids for optimizing the performance and APUs.

Okay. Anything else? Jim, you're not going to say anything?

MR. COLE: One thing I guess -- Jim Cole with Southwest Research -- we do want to improve the efficiency of these lean-burn spark-ignited engines, but bear in mind that these engines that are lower efficiency by 10, 15, 20 percent are

one-third the emissions of diesel or whatever, also. So know when you --

DR. LOSCUTOFF: It's a trade-off.

MR. COLE: There's kind of a trade-off. There are technologies that can get you both and NREL is pursuing them.

DR. LOSCUTOFF: Ray.

DR. RAY SMITH: Smith again. I think if you're serious about natural gas on heavy-duty vehicles, you really have to do some things to support LNG as opposed to just CNG. And I don't see very much of that being done.

DR. LOSCUTOFF: Yes.

DR. RAY SMITH: So if you really want to get the range and get the truckers' attention, I think LNG is going to have to be promoted in some way. Those technologies that are barriers in the LNG storage, I think, need to be entertained.

DR. LOSCUTOFF: Okay. Good. Support the LNG.

DR. BINING: If I hear your comment correctly -- Avtar Bining -- your technical barrier is onboard energy storage going full range?

DR. RAY SMITH: Onboard storage. Yes, fuel storage.

DR. LOSCUTOFF: Yes.

MR. NORTON: Paul Norton from NREL.

I'd like to agree with that and expand on it a little bit, is that I think on the

onboard storage size the barrier is mainly a cost barrier. I don't think the technology has to move too far ahead in terms of performance, but the tanks and the fueling system is substantially more expensive than a simple aluminum diesel tank, and that's a major barrier.

DR. LOSCUTOFF: Okay. One more.

DR. BINING: Avtar Bining. One issue that I had often observed in heavy-duty alternate fuel engines is a power loss, like overusers used to using those engines, that the higher power, high, high delivery kind of situation on entry boost. Do you perceive that power loss is a major technical barrier for that particular technology, to get accepted in the market?

DR. LOSCUTOFF: Right there. A question. There's an answer over there.

MR. NORTON: Paul Norton from NREL again.

I think that that has been a problem, but I think it's being overcome now. For instance, the Mack E7 engine, the natural gas version is rated at 25 horsepower higher than the equivalent diesel. It also has high torque. And I see the Southwest person has stepped out, which he would probably be the best answer to that, because Southwest has done work with Mack and John Deere to produce engines that are of similar horsepower and torque rise characteristics of diesel.

I think that has been a problem, but I don't think that's one of the issues

that needs to be focused on by TETAP. I think it's kind of well underway of being solved.

MR. VLASEK: Greg Vlasek. I agree. It's an issue of concern to certain users in certain applications, but, as has been pointed out, the number of products that's available is helping to compensate to fill in those niches where there is not adequate power for natural gas engines.

And one big area is in, for example, Class 8 long-haul trucks, where there's just nothing out there yet in the horsepower range that they would need, and whether the engine has to be -- there's ways to compensate for the power loss and sizing the engine and getting it into the right application and getting the right engines available. So all of those things I think can be dealt with by more demonstration of different types of engines and different applications.

MR. NORTON: Paul Norton from NREL.

If I can play off that, I agree with that. Now there's a new engine coming on by Caterpillar, the C12 dual fuel which I think will address the higher end of the market.

But it's true that trucks are moving towards higher and higher horsepower. And the highest horsepower natural gas engine now is -- well, 300 horsepower dedicated and 325 dual fuel.

So there is some need for that top end, but I think that's going to be filled

in the next year or so by the C12 and the 3406 dual fuel engines. So I'm not sure that just moving natural gas engine availability to higher horsepower is worth focusing on, unless you can also hit the higher efficiency.

DR. LOSCUTOFF: All right. In the interests of time, I think we're probably just pretty well -- excellent suggestion. Any last comments as he wraps it up, or go on to the next one?

All right. New technology. What is your...

DR. HALPERT: I'm Gerry Halpert from the Jet Propulsion Laboratory.

And our interest is in fuel cells, so I'd like to talk about fuel cells. But I hope we don't turn people off here about my comments, but I'd like to be out of the box a little bit, and suggest that in fuel cell technology there's an enormous amount of money going into hydrogen fuel cells, which I'm not sure would ever be desirable for vehicles, and reform ethanol technology, which has been up in the hundreds of millions of dollars, as you know, by Daimler's support of Ballard.

And so I think the real payoff for the CEC would be in the direct methanol fuel cell where they can really make something happen. And I think the two issues there would be in system designs and improved cost of the parts that go into the PEM cell.

But I think my point about the fuel cell is there's so much money going

into fuel cells by the big three and by other people, that for CEC to put their small amount of money into it is just not even icing on the cake. It's like a sprinkle on the cake.

So the big payoff would be in something that would be a rather simple system. The direct methanol system that uses methanol and water only and no reformer, would be a big payoff for the average car owner and vehicle owner.

DR. BINING: Avtar Bining. Gerry, you mentioned two issues. One was the system design. What was the second one?

DR. HALPERT: The system design on the lower cost of materials for the PEM stack.

But I'd like to, if I would be permitted to suggest this, I'd like to make this fuel cell as direct methanol fuel cell technology and not just general fuel cell, because, like I say, I think for the CEC to put money into fuel cells in general it would be a waste of money for them. With the money they have, they're not going to really make any progress.

But the big payoff is in the direct methanol fuel cell system. So my suggestion is to change the title to direct methanol.

DR. LOSCUTOFF: Direct methanol, change the title.

Other comments? What would you put on here?

MR. FONG: Put it under "attributes."

DR. LOSCUTOFF: I would put it under what is needed, direct methanol, the fuel cell and direct methanol. We'll put it over here, okay?

Another comment? Okay.

MR. RAMBACH: Glenn Rambach, Desert Research.

Gerry, I agree with you a lot and I disagree with you a lot. Maybe it's worthwhile, at least, so we have enough paper to separate fuel cell technology with DMFC, but I think in general they probably should be categorized the same.

One of the misfortunes of the fuel cell world is there's seven different types of fuel cells if you include zinc and you separate methanol from hydrogen PEM. So there's a lot of things to choose from.

But I think if you are looking at advancements in fuel cell technology, you'll have the opportunity to review proposals from people who should have the choice of showing that there may be still be something where there's a large lever for CEC in the nonDMFC and also dovetails very well with some of the direct methanol fuel cell work and the Kobel (phonetic) stuff, for example, I think is one of those.

So I'd argue against culling out the direct methanol from the fuel cells, because -- I mean there are seven different fuel cell technologies, and you might get something for an alkaline fuel cell that could surprise you as well, or a celanoxide (phonetic) fuel cell.

DR. LOSCUTOFF: Recommend something then.

DR. BINING: The technical area.

MR. RAMBACH: I think I just did. Don't do it, Jerry.

DR. LOSCUTOFF: Technical barrier. And then what's the barrier? What needs to be done?

MR. RAMBACH: Well, another thing is very often the lower cost, the lower cost issue, more important than finding lower cost I think is finding the right entrance to market. Very often we say a lower cost, because the automobile engine is \$10 to \$40 a kilowatt. And I'm perfectly proud to, say, as I mentioned over lunch, to pay \$350,000 a kilowatt for a battery. And it's a battery that lights this watch here.

The same thing works in transportation. If you map out the cost per kilowatt or the size of a power plant in transportation application, you find you go over three orders of magnitude in cost and two and a half orders of magnitude -- excuse me -- three orders of magnitude in size, two and a half orders of magnitude in cost. So there's a huge place to work out there.

And if an objective is to enable a technology to become commercially viable, it ain't going to become commercially viable in fuel cells in the automobile first. It's going to be somewhere else. And there are a lot of places in transportation to satisfy TETAP where that could happen.

DR. BINING: Avtar Bining. One comment on that, that can help you in deciding more technical barriers. My experience with fuel cells over the last five, six years is that membrane electrode assembly in the whole fuel cells costs somewhere between 70 to 75 percent of the total cost still. But like catalytic loading membrane cost and the assembly, that is still in the range of 70 to 75 percent, based on some of my experience, that I have been working with these contractors.

That is the kind of information we are looking for, that instead of looking at some component that costs very little and then making lots of them there and then having only two percent improvement in the cost reduction, can we focus on something that is costing much more and making even 10 percent improvement there may give you like seven percent cost reduction? So that is what we are looking for, if there is some critical element within that technology, where we can contribute --

MR. RAMBACH: Yes, there is.

DR. BINING: -- other funds to overcome that barrier.

We may not be able to achieve a hundred percent in that category, but can we make some technology advancement with our little contribution. So that is what we are looking for.

MR. VLASEK: Greg Vlasek. A bit off point from the fuel cell specifically,

but I think it's a very important point that's worth making in this fuel cell discussion. And Gerry's comments make this a good example.

And that is it's very, very important that the Energy Commission utilize whatever resources are necessary to make sure that all of these projects in the evaluation phase are checked to make sure that they are not duplicative and that you're not funding something that is being funded by PNGV or somewhere else.

Because I know that lots of consultants and manufacturers and developers and so on, if they can get two clients to pay for the same thing, they will gladly do so. So it's critical with the dollars that you have that you're checking to make sure that you're adding value to the entire process.

DR. RAY SMITH: Smith, Lawrence Livermore.

I'd like to suggest that you entertain or request people to consider the possibility of small-scale methanol manufacturing so that you could actually place, potentially place something like that even at a station. So you've got a natural gas station. You can make methanol from natural gas. Can you do that on a small enough scale economically that when Daimler-Benz comes over with their methanol reformer input to their PEM fuel cell, that you'll be able to supply fuel?

I mean it's an infrastructure-building thing for both direct methanol fuel cells or methanol fuel cells or fuel cells that are using methanol to be reformed.

DR. LOSCUTOFF: So it's a total infrastructure then, is that what you're preparing, to kind of be ready? Okay.

DR. BINING: Avtar Bining. In response to Ray's comment, can we hold that until we come to fueling infrastructure technologies?

DR. RAY SMITH: Sure.

DR. LOSCUTOFF: We can wait. Yes, that would be fine.

Yes, it's a barrier to fuel cells, like an infrastructure.

DR. BINING: Technical barrier.

DR. LOSCUTOFF: Yes.

MR. VLASEK: Greg Vlasek. Yes, that's the point I was going to make. If you're talking specifically about methanol, anything, any discussion of methanol technology, you have to list infrastructure as a barrier. But if you want to make all infrastructure issues a separate item, that's fine.

DR. LOSCUTOFF: My only concern is we won't get that far. Oh, well, we may. Okay.

DR. BINING: Move on? Any other technical barriers?

It seems like fuel cell technology was a hard topic, but I don't see any technical barrier here other than just these two.

DR. RAY SMITH: Well, cost.

MR. VLASEK: Cost, cost and cost.

DR. RAY SMITH: Cost, cost and cost. They're there. Lower cost.

DR. BINING: Okay. Anything else on this one?

DR. LOSCUTOFF: Well, what needs to be done? I guess in this case you want to try support of specific projects, a demo, or what's the best way to approach with the money, the limited funds the CEC has? What's the best way to use those funds, a demo, a specific project?

You suggested to run the methanol cell, just simply run a methanol fuel cell?

DR. HALPERT: Gerry Halpert again with JPL.

We've demonstrated small versions of the fuel cells. We know we can do that.

But I think trying to develop new biplates, for example, or biplates that are low cost, easy to make and using membranes other than for the PEM, using membranes other than Nafion, which is a hundred dollars a square foot, which doesn't make it very practical. Those are the kinds of things. The materials that go in the PEM.

DR. LOSCUTOFF: Okay. New materials.

DR. HALPERT: That go in the PEM, there's the big payoff there in terms of cost.

DR. LOSCUTOFF: Okay. New materials, replace.

MR. RAMBACH: A lot of the M&E --

DR. LOSCUTOFF: That'd be new ones needed, not barrier. Okay, either way.

MR. RAMBACH: A lot of the M&E costs, the membrane electrode assembly costs are going down goes aggressively pursuing marketing membrane electrode assemblies at something on the order of a couple dollars to \$10 a kilowatt, which is very low.

To carry the comment on the bipolar separators a little further, I think it should be more general and alleviate the cost barrier of the bipolar separator, because there are other things to do besides material or process choices. And that also leads to manufacturability issues and so on, because manufacturability is one of the other problems. It's a sister problem to the materials and bipolar separator problems -- issues.

MR. FONG: I would agree.

DR. LOSCUTOFF: Manufacturability, materials.

DR. BINING: Avtar Bining again. A question to Gerry.

Gerry, catalytic loading, do you feel that is a critical element in fuel cell technology? Like I am seeing numbers like milligram percent to scale to coming down to .25, and people are shooting for even lower than that, and that is minimal cost.

DR. HALPERT: Yes. We -- well, yes. You've seen ranges from .5 to .8 -- to eight milligrams. And a lot of the .25 things are in the laboratory. They're not in fuel cells that are actually practical these days. As a matter of fact, it's my understanding, is the Ballard fuel cell is one to two milligrams of platinum still. And ours is anywhere from two to four.

Loading, platinum loading is extremely important because obviously when you're building big fuel cells, the fuel cell stacks, you get a high cost item. However, there's some discussion like, as Honda is doing, and that is to leasing the fuel cell because it can run for very long periods of time. Ours, essentially, we've had 4,000 hours of use in our direct methanol fuel cell with very little degradation.

The point is they have a lot of life and if they can be leased, like the batteries are for Honda, then that doesn't become as much of a cost item as if you're buying the platinum and then having to store yourself and own it yourself.

DR. BINING: Avtar Bining again. So it is a strategy issue rather than a technical issue, I would say?

DR. HALPERT: Well, I would say that. My partner over here --

MR. RAMBACH: Is this the Doug Lynn-Xerox discussion (phonetic)? That's how Xerox started in '61. A Xerox copier was \$25,000 and you couldn't

find anybody to buy them, so they leased it and then charged by the page. And it's the same thing here. Only here there is a reason because it happens to outlast its alternative or the thing it's replacing.

DR. BINING: And move on?

DR. LOSCUTOFF: Yes.

Let's be ornery and let's not pick one that he had suggested earlier.

DR. RAY SMITH: Infrastructure.

DR. LOSCUTOFF: Oh, there we go. You're reading my mind.

Infrastructure. Not on the list of four. It's on the list of six, but not the list of four.

MR. SPIEWAK: Dave Spiewak with the U.S. Department of Transportation. I've been kind of waiting for the right time to jump in with this, and I guess this is as good a time as any.

I've heard some really great ideas here. This is fantastic, how many people have such good ideas with these technologies. But I really think you're putting yourselves in a box by trying to pick technologies now that you're going to receive proposals on sometime during the year. I think you're limiting yourself way too much.

I think the proper approach, and you can handle this through your pre-proposal process or your white paper process, is you just state your broad,

overall program goals. You're looking for technologies that will reduce petroleum dependence, will reduce emission, will improve efficiency, and let people submit white papers. Accept any random idea that anybody wants to submit. And the white paper process makes it very inexpensive to do that.

At that point you convene a panel of people like this who then review these things, and you can toss out the obvious losers, and you're going to be surprised by some obvious winners. And then you're going to have to deal with a whole bunch of gray ones.

And at that point you have an interactive process with these gray-white papers, where you say, "This will be a great idea if you may be demonstrated a stronger commercial application," or "if you could show us a better efficiency," or "if you could do that." You have an interactive process with these people.

And then when they reach a point where they believe that their proposal to you in a white paper form is good enough for a full-blown proposal, then they'll submit it. And if they never get to that point, they won't.

I mean in that way you're not going to limit yourself from accepting some really nice proposals that you'll never expect in a million years, and you're going to get, if you make it a broad approach.

We're struggling with this ourselves right now. We're setting up a joint program office with the Department of Energy to do this kind of stuff. I mean

our program, hopefully, will be funded with a little bit more money, but we're going through the same kinds of issues: How do we want to solicit proposals.

And what we've come up with by far is the best way to do it is to establish the most broad program goals possible, accept the ideas and deal with them as you get them. And, for instance, if you get a white paper that deals with efficiency of heavy-duty diesel engines or natural gas engines, this guy right here is the guy you want on your proposal evaluation team. And he can bring these kind of ideas to that evaluate team.

And there's a whole range of people in this room who will bring that expertise at that point. And then as long as you keep it all above board and you don't allow politics or friendships to determine who gets selected for what proposals, as long as you've established definite proposal evaluation criteria, and there's a list of 11 here that are very good, I think you're going to be a lot better off in the long-run. And I think it will be a lot more successful, firstly, in getting more proposals; secondly, getting better proposals; and, thirdly, more successful proposals.

So I guess I had just to throw that out.

DR. LOSCUTOFF: I can't argue with that.

MR. FONG: Is applause appropriate?

DR. LOSCUTOFF: It sounds really good.

MR. SPIEWAK: And I don't mean to cast aspersion on anything that's happening, because this has been really good. I mean there's BEEN some great ideas kicked around here. But one of the chief complaints that we hear around the country over PNGV is that DOE has picked the technologies that they want to see succeed. People are saying, "Wait a minute. I had a whole bunch of other ideas that I thought would be just as good." You know, so they kind of pigeon-holed themselves.

DR. LOSCUTOFF: And PNGV has a lot more money than CEC does.

DR. RAY SMITH: Oh, yes.

DR. BINING: Avtar Bining. In response, a comment on that. Of course, just in the past -- that is what we have been doing in the last three solicitations, that we wanted to give open opportunity to everybody to suggest whatever they want. And we felt that with our one million, two million, it becomes a too scattered approach, like a shotgun approach. And then whatever gets hit, gets hit.

So we thought that if we can talk to some key stakeholders or some key people in their industry, then we can narrow down our focus on some of those technologies that are of immediate focus. And then still we can -- and the other technologies, if somebody has some wild idea of some technology that doesn't fit into these, we can still accept those proposals.

So the effort that we are trying to make today is to at least focus us from that whole list of probably, how many, more than a hundred technologies that I listed in those six categories; that if we can focus on five, six, then that is some kind of satisfaction to us that we are putting our money into those categories. And then we have a last category as others. And those proposals can still come in, but then at least we may -- we can satisfy ourselves by saying that we made an effort to narrow down those technologies that we felt that money should be put into.

MR. SPIEWAK: Until you said the word "others," I had something to say, but I think that's right. These meetings, these forums that CEC has had, I think, have been a great learning experience for everybody that participated, including CEC. And it seems to me that learning process should extend itself until the proposals are in because that's also going to be part of the learning process. So keeping that as open as possible, you have to expect the unexpected.

DR. LOSCUTOFF: Okay. I guess the --

AUDIENCE PARTICIPANT: All hybrid people leave the room.

DR. LOSCUTOFF: All hybrid, that's it. They got their two bits in. I guess from this -- oh, go ahead, Ray -- Mike.

DR. RAY SMITH: Yes, Smith. Attributes in terms of infrastructure technology, it seems to me that a clear distinction can be drawn between gaseous

fuels and liquid fuels. I think the recent, dare I call it, fiasco, the issue with MTBE in reformulated gasoline seems to have been an oversight, where the people that are concerned about the air didn't talk to the people concerned about the water.

If we go towards gaseous fuels, we avoid that problem. And so I would like to put under attributes promotion of gaseous fuels to avoid other contamination or remediation issues.

DR. LOSCUTOFF: Yes. MTBE problems, avoid. Yes.

So gaseous, infrastructure, technology.

DR. RAY SMITH: Well, I guess you're ready to talk fuel cells overall, aren't you?

DR. LOSCUTOFF: Yes.

DR. RAY SMITH: In the infrastructure?

DR. LOSCUTOFF: Yes.

DR. RAY SMITH: All I'm saying is that gaseous fuels have a distinguishing attribute, but they don't have -- gaseous fuels do not contaminate water, I guess would be --

MR. VLASEK: Greg Vlasek. I guess the biggest attribute for any alternative fuel is that it provides greater flexibility and diversity in our fuel mix for California, which is one of the principal, overriding goals of the whole

process.

What else do we have up there? Commercial potential. I think the commercial potential is very important for -- I mean each one of these technologies that we've talked about so far is going to have infrastructure issues. That's clear. And they're each going to have barriers. Specifically I can speak for natural gas, but I think it's going to be true across the board.

The biggest barrier is the cost per unit of fuel delivered, and that should be the primary focus, in my opinion, of any dollars going towards infrastructure, is looking at ways to standardize with the most efficient types of infrastructure and equipment that will be the cost per unit of fuel delivered down regardless of whether it's natural gas, methanol, electricity, what-have-you.

DR. BINING: Avtar Bining. The one technical barrier in natural gas fueling infrastructure that I have come across is the high energy cost of compressors. Second is their durability and reliability. And third is capital cost.

From the Energy Commission's perspective, we do not want to put more energy through that system than what we get out of it.

Do you feel that improving the energy cost of those compressors or some other systems in the natural gas fueling infrastructure is a critical element we should look into?

MR. VLASEK: Yes. I think we just said the same thing in a slightly

different way, Avatar.

DR. LOSCUTOFF: Yes.

MR. VLASEK: And I think it's true for other -- I mean we were just talking about the straight methanol and the possibility of new strategies to get methanol out in the field, if that's suitable for a fuel cell technology. I mean it boils down to cost.

And I'm sure there's opportunities to reduce costs. I can't tell you specifically what they are or have any in mind. But I'll have a pre-proposal for you by the time you get around to asking for them, I guarantee.

DR. BINING: So can I put my technical barrier there as a --

DR. LOSCUTOFF: Yes. He stated a positive; you stated a negative. So go ahead.

DR. BINING: -- high energy cost?

MR. WIENS: Jerry Wiens, Energy Commission.

One possible technology that we are likely to be looking into in the near future in a program that I have funded is LCNG stations. Obviously it assumes that LNG is available at a good price and that the demand can be matched with the equipment. But obviously if you put in an LCNG station without any CNG demand you've bought equipment you don't need. And, similarly, if you just have CNG demand, it may not be economical. And we need to investigate the

range of the market between the two. But that is one way that would reduce the energy consumption, at least at the site, in compressing the gas.

MR. LUSBY: There are safety issues with some of the fuel, too. Art Lusby from Northrop-Grumman. There are safety issues on some of the fuels.

MR. NORTON: Paul Norton with NREL.

Mr. Smith, I think it was earlier, mentioned that LNG would be very important if you wanted to move alternative fuels into trucking. So I think it is important to look at LNG infrastructure issues, and that's one of the barriers. And LCNG projects help that.

One of the issues I think in any LNG infrastructure project that should be addressed is methane venting, which has been a problem with current LNG refueling stations, and is going to, I believe, get more attention as the global warming issue is focused on more, since methane is a very active greenhouse gas.

So if you did do any LNG infrastructure projects, regardless of their primary focus, I think methane venting should be addressed and it should be a vent-free station.

DR. HALPERT: Gerry Halpert at JPL.

I feel like there is a big gap in the attributes, because I don't think gaseous fuels are the only possible potential fuel. Liquid fuels are certainly very viable

and, especially in light of using them in the same way we use the present fuels, by going to the service station and filling up very simply with your fuel tank.

And some of the fuels have exceedingly large energy capability. A liter of methanol has five kilowatt hours worth of energy in it. So I don't think you want to leave out liquid fuels on this as well.

MS. MARTIN: Cecile Martin, California Electric Transportation Coalition.

I was going to say on infrastructure for electric transportation that there may be some opportunities to do work with some of the large vehicle shuttles and buses in terms of their charging systems, efficiency and power quality.

And also the off-road vehicles that are still using old technology charging. They could be using much more efficient charging.

In addition to that, you might want to consider some of the technology that's necessary to be able to bill for electricity in public charging situations, in order to deliver that electricity more efficiently and at more appropriate times and cost.

DR. LOSCUTOFF: So what do you do, just promote demo projects in these areas; is that the best way to approach it, because you're not looking at development. Are we looking at any developments in these areas, any particular -- or are we just looking at demonstrations at the feasibility of the whole thing? What are you looking at?

MS. MARTIN: Well, I'm not recommending any specific projects.

DR. LOSCUTOFF: Okay.

MS. MARTIN: But I think that's an area that the Energy Commission has a specific interest in, because of what you do in general because of the electricity.

And, also, it's an area that just could really develop efficiency in off-road vehicles, which there's a lot of information about now, new information because the Air Resources Board is getting ready to do regulations in those areas. We've seen how much energy is used in that sector, as well as the emissions that are produced. So it's kind of an easy fix, but there's no focus on it. There's really no need.

DR. LOSCUTOFF: Yes.

AUDIENCE PARTICIPANT: What are these vehicles, are these off-road electric vehicles, golf carts?

MS. MARTIN: Well, I'm not thinking of golf carts specifically, but from forklifts to any of the off-road vehicles that are used in airport applications as airports begin to electrify. And a lot of the old systems are being used. They just have not -- they're not high-tech systems.

MR. VLASEK: Greg Vlasek for the GV Coalition. Relative to the LCNG that was mentioned, which would provide vent-free operation of LNG stations or would accommodate that for some large-type commercial CNG refueling

stations as well as for home refueling, there are opportunities, I would say development opportunities for refinement of some of those technologies, not just demonstration. I think there's some work that could be done in the development area, but mostly in the area of refinements of technologies that are very close.

DR. LOSCUTOFF: So refinement and demonstration are what you mean to say. Refinement and demonstration, okay.

DR. BINING: Avtar Bining. I have two comments.

One comment on the natural gas fueling infrastructure. In some fueling stations I have seen, they have been using high pressure lines to fill low pressure tanks, but in using that pressure drop as a way of compressing gas for refueling of vehicles. That is one technology in natural gas I think that is being used quite effectively.

You don't need any compressor. You are simply having the high pressure line coming into your place and from there it goes to the distribution lines at lower pressure. And the pressure drop is used to refill your fuel tanks in the vehicles.

On the methanol side, one idea that we have been talking about for quite some time and that refers to Jerry's direct methanol fuel cell technology category, that is that if we have to use the existing methanol fueling infrastructure from

M85 to M100 kind of application and still like to have some flexibility of using M85, then one area within that is for blending wall, that technology, so that you have M100 tank, and if you still use M85, then the consumer should be able to use that system by selecting. And the blending wall system automatically gives you M85 there. That is one technical barrier that I think the fueling infrastructure technology can handle methanol.

Any other examples like that? If I get some proposal on blending wall, I will know that that is the technical area I am to focus on.

DR. LOSCUTOFF: I guess the barriers' cover, in essence, provide as a guidance as to what kind of proposal we should be entertaining, so if there are no other comments we can drop this. Okay? Anything else?

If not, I think we've got enough here, Avtar.

DR. BINING: Okay.

DR. LOSCUTOFF: Okay. It is 2:40. We started a little bit earlier. And I guess for the sake of drink, as long as the seat can endure, and I think we've covered the major issues on this one. Is there any other you really want to hit hard, like we mentioned batteries and stuff. There are three others in here.

We've got a pretty good idea from you that these are important. Do you feel there are others that are more important than these, that are fairly important that we should cover, or perhaps we should do what was suggested, just accept

everything and look at the best ones. And that might be one approach to take.

MR. GUERIN: J. T. Guerin from AeroVironment.

Yes. I would like to reiterate, I liked his idea of let them all in, and then just divide them into subgroups by specialty and by people who are qualified and knowledgeable in that area and get their feedback on those. Because I'm a battery person, an ultra capacitor person. I really don't have a lot to say about CNG and all these other kind of infrastructure issues associated with natural gas. But I'm sure I'd have a lot of input on batteries and their applications and HEVs.

And I think it would be a good idea to divide this into subgroups based on different technologies and get the appropriate technical personnel for each one and take a look at what you feel are kind of the best ones or ones that are borderline in each area.

DR. LOSCUTOFF: Well, just because the batteries weren't covered in this session right now it doesn't mean they're going to be excluded. In fact, it was one of the items that was listed. It's just infrastructure kind of jumped a little bit ahead of us. It seemed like we had a little bit more enthusiasm for infrastructure.

MR. GUERIN: Well, I kind of lump batteries in with part of the --

DR. LOSCUTOFF: HEV, hybrids.

MR. GUERIN: -- as hybrids.

DR. LOSCUTOFF: All right.

MR. GUERIN: As energy storage in general, whether it be ultra capacitors, flywheels, batteries, however you want to look at it.

DR. LOSCUTOFF: I have a feeling, even though I kind of break this down into categories, I think ultimately we'll get there, an unlimited number and kinds of proposals. And I'm not so sure even by limiting it by these categories we're going to limit the kind of proposals we're going to get, as people like to write proposals, love to spend money writing proposals. But, in any case, --

MR. GUERIN: It will always be in other categories.

DR. LOSCUTOFF: The other category. Under the other categories, yes. Under all other categories.

Okay. What I'm going to do now is I'm going to invite Dan to kind of wrap it up and let you on your way.

MR. FOLKMAN: One more quick comment here.

DR. LOSCUTOFF: Oh, one more. I'm sorry.

MR. RAMBACH: I apologize. In a fit of drowsiness I missed seeing that there was a big white space under fuel cell technology, particularly in the commercialization potential. I guess I read it as "compote" and just wasn't paying attention.

(Laughter.)

MR. RAMBACH: Well, actually, see, it depends on the application. And it's high, very high and near term for utility vehicles, like the ones that were mentioned a short while ago, scissorlifts, forklifts and things, where the function and value of the function is commensurate with the cost of the power plant. And it's low and long-term for the automobile. And somewhere in the middle is heavy-duty, and so on.

But I think it's important to recognize that it's not like fusion, and perpetually a long ways away.

DR. LOSCUTOFF: Yes. Okay. It's a little bit like a brief.

MR. FONG: I wanted to mention a few things here in summarizing today's meeting. We're hopeful also that after today, when you go back to your respective offices, you can think about also submitting to us any suggestions or recommendations on what we're trying to do here in writing.

We have a window of time here before we need to set a process in place to actually start the next cycle of awards. We feel that if we get any written material from you, we'll be able to fully consider that material as we lay out our next process, if we get that material by something like December the 10th.

Also there was earlier discussion this morning about the relative merit of TETAP money being invested in diesel fuel technology advancements. I just wanted to remind or take note that the Commission also is directed under

legislation to conduct a diesel fuel demonstration program. That program is financed from fines which are assessed trucks which fail to pass the roadside inspection test that is administered by the Air Resources Board.

So there really is an entirely different funded effort within the Commission that specifically looks at diesel engine, diesel fuel technology advancement.

We're hopefully that the roadside inspection program will resume in early 1998. It's been in suspension for almost two years now because of a variety of issues that the trucking industry had with that test procedure. But that roadside inspection program in the past generated on the order of a million dollars annually in fines. We expect that that is going to be the case when that program resumes in 1998. So TETAP isn't the only resource that might be utilized here at the Commission for advancing diesel fuel, diesel engine technology.

Now from this morning's discussion, I thought we had almost universal consensus on identifying the key process issues that our stakeholders are faced with when they consider applying to TETAP.

Now the burden rests on the Energy Commission Staff to do what we can within the constraints that we work under to make some changes to that process so that it's a friendlier process.

We can try to reduce the timeframe that is currently in place to get our

money out there a little quicker. We're also looking at perhaps having more than a single submittal due date, to also allow for flexibility for those stakeholders who may not be ready to submit a proposal to us when we set an initial deadline. But then there's some trade-off there in that the total \$2 million may not be available as we proceed in time. But we're willing to consider those kinds of flexible options.

On the technology side, I felt that, again, the stakeholders pretty much agreed with the sort of key technologies that have been identified to date. Now we recognize there's still some disagreement here over whether or not we should have a totally open type of solicitation where all technologies are going to be equally considered versus the targeted approach.

Earlier feedback, I think, that we have received seems to point us toward the targeting approach. And that's more because of the limited resources that we have. We don't want to give stakeholders the unrealized expectation, I guess, that they're going to have an equal chance at receiving a part of this award.

There are some key technical areas, I think, where this quantity of money can be helpful, can allow for some good progress on improving the commercial viability, commercial potential of some of these nonpetroleum-based technologies. And that's what we would like to see. Yes, we may miss out in some other advancement, but it doesn't then fit within the longer-term goal that

the Commission may have about reducing petroleum consumption, maintaining environmental protection, et cetera.

But, as Avtar said, we still have the other category. We're not locking the door totally. But I think we need to make sure that our stakeholders recognize that there are some targets that we want to look at.

And if they can put together good proposals, good teams that respond to those identified targets, then there's a good likelihood that they might be successful. And we want to create that feeling that people have a chance, if they know what we're looking for and they put together projects, that their time and effort is not going to be wasted.

We're actually extremely pleased with the response that we've received on today's forum. You've all made, I think, some important contributions to our understanding of the technology issues that you believe merit some additional investment. Those, I think, we'll find really valuable as we finalize this next solicitation.

But the other thing that I think the Commission Staff is very interested in is that we want to maintain frequent dialogue, frequent communication with all of you who have existing programs that are trying to improve various technologies.

We feel that in the past, at least because our solicitation wasn't a very --

sort of consistent and guaranteed process, we would lose some knowledge about what's happening out in the field. We want to, though, maintain and make sure that we know what's happening with your own programs. We want to remain current. We'd like to be able to modify our solicitation as time goes on. And that means that we need to know what you folks are interested in, what sort of technology advancements make the most sense.

So we want to reemphasize whenever you're in Sacramento, please try to stop by. Our Staff is always willing and prepared to meet with you, to sit down with you, go over ideas that you may have, and allow us additional time to actually put programs together that might respond to those good ideas. So are there any other comments here that I might take before we close this session?

MR. LUSBY: Just one quick question. When will your next solicitation be out?

MR. FONG: Well, let's see. If we really begin the process of putting together that solicitation, my guess is that it's going to be in the first quarter of '98. The sooner, the better.

We would like to make awards before the end of our current fiscal year, which ends on June 30th, 1998. But, again, a lot depends on how quickly we can construct a suitable process, how quickly we can get approval for the variety of changes that we want to adopt.

Jerry, you had a -- oh.

MS. BROWN: I have a couple of comments at the end. Two things I heard this morning. One was the desire for consistency in the amount of funding that we have available.

I cannot stress enough the need for a long-term stable funding source. And that is something that we are working very hard to identify. So if any of you have suggestions along those lines, we would very much like to hear from you. So I wanted to make that point.

Also, if you have specific suggestions as to what specific technology barriers you feel are achievable in the next solicitation, we would very much welcome that kind of feedback on or before December the 10th.

And, lastly, I want to stress again the need for collaboration and synergy. Again, we are trying to encourage cost-sharing and collaborative funding. So I wanted to make that point, I think, probably here in closing. So, once again, thank you all for your input. I, for one, found this to be very instructive today. And this meeting is adjourned.

(Applause.)

(Whereupon, the Forum adjourned at 3:00 p.m.)

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I, **GEORGE PALMER**, a duly-commissioned Electronic Reporter of **Palmer Reporting Services**, do hereby declare and certify under penalty of perjury that I have recorded the foregoing Advanced Transportation Technology Stakeholders Forum, which was held and taken at the **STATE of CALIFORNIA ENERGY COMMISSION**, in Sacramento, California on the **21st day of November 1997**.

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